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THE NATIONAL ACADEMY OF SCIENCES

INTRODUCTORY ADDRESS OF THE PRESIDENT[1]

By Dr. FRANK R. LILLIE

MAY I take this opportunity of repeating what I have already said to the president of the university, how much the National Academy of Sciences appreciates this opportunity of meeting in Charlottesville as guests of the University of Virginia; and how very grateful we are for the hospitality of the university, its faculty and friends of Charlottesville and Virginia.

I would like to use my advantage as president of the academy to answer the very ancient and still natural question, "What is thine occupation and of what people art thou?"

As a corporate body the academy is seventy-two years old. It is the only scientific body that operates under a charter from the Congress of the United States, and which therefore reports directly to Congress itself. Under its charter it has control of its own membership and property, but is pledged "whenever called upon by any department of the government, to investigate, examine, experiment and report upon any subject of science or art." It necessarily has its headquarters in Washington.

To fulfil its obligations it is necessary that the academy should be broadly and strongly representative of the scientific personnel of the country; indeed, the effort to meet this necessity has determined the membership policies of the academy from its foundation: thus the division of the academy into eleven sections representing the principal divisions of science and technology to ensure breadth; and the limitation of members to secure individual and corporate

[1] Given at the dinner of the National Academy of Sciences, Charlottesville, Va., November 19, 1935.

strength. Its obligation to the nation to secure the best counsel in times of need on all questions of science and technology is a unique and heavy responsibility of this organization.

However, we are also a scientific society in our own right, and the reading of papers presenting the discoveries of members and their guests constitutes the chief function of our annual meeting held each April in Washington, and of our autumn meetings held at various universities throughout the land where we seek to improve acquaintanceship.

As you have had the opportunity of sampling our activities as a scientific society during the present meetings, I may limit my further remarks to the governmental and representative relationships of the academy. The former implies the latter; for, if we are to be of service to the government in a sense different from the very important and numerous scientific agencies of the government itself, it can only be by virtue of our capacity to bring to the aid of the government the best scientific opinion and information of the nation, and of the world, on the problems of the scientific agencies of the government. It is impossible to do this from the membership of the academy itself; and it would still be impossible even if the membership were multiplied. Hence the necessity of being a representative organization in the sense of possessing the cooperation of all the scientific organizations of the land and of their members.

Omitting any review of earlier instances of inquiries made by the academy on behalf of the Federal Government, I would like to note that the exigencies of the great war required the formation of a special agency of the academy in order to be able to carry out its obligations under its charter; at the request of President Wilson in 1916, such a special agency was organized by the academy as the National Research Council. In 1918, by executive order, President Wilson, after recognizing that the "work accomplished by the council in organizing research and in securing cooperation of military and civilian agencies in military problems demonstrates its capacity for larger service," requested the National Academy of Sciences to perpetuate the National Research Council, with much wider functions, serving in general to implement the broad charter obligations of the academy.

Under the academy and its special agency, the National Research Council, very broad contacts have been established: (1) with federal bureaus and departments, (2) with university and independent research institutes, largely through national scientific societies representing the various sciences, and (3) with engineering and industrial research through the Engineering Foundation and leading engineering societies. Many international affiliations have also been formed.

Again, in order to meet special needs of the government arising from the rapid expansion of governmental organization and activities under the economic emergency of the past few years, President Roosevelt appointed a Science Advisory Board in the summer of 1933 "with authority, acting through the machinery and under the jurisdiction of the National Academy of Sciences and the National Research Council, to appoint committees to deal with specific problems in the various departments." This has been a very important agency and has rendered numerous services to departments of the government.

Thus, the simple provision in the charter of the National Academy of Sciences—"whenever called upon by any department of the government, to investigate, examine, experiment and report upon any subject of science or art"—has resulted in the establishment of complex and powerful agencies.

With the passing of the emergencies which called the special agencies into being the academy is now combining its governmental functions into a single committee of the academy.

Functions of similar kinds have always characterized governments, their present high development is the result of a long process of evolution. In this country we can trace a fairly long history antecedent to the establishment of the National Academy of Sciences.

In the seventeenth century the great Mr. Boyle, Bishop Wilkins and several learned men proposed to leave England and establish a society for promoting knowledge in the new colony of Connecticut, of which Mr. Winthrop, their intimate friend, was elected governor in 1657.

Charles the Second would not allow such a loss to Great Britain and took them under his protection in 1661 and established a society which received the title of The Royal Society of London.

For more than a hundred years this society was for our country also what it still is for the British colonies throughout the world. Among the Americans eminent in science on the list of fellows in those early days were four from Virginia: John Banister, clergyman and naturalist; Reverend John Clayton, anatomist; John Mitchell, naturalist; and Colonel William Byrd, naturalist.

In 1743 Benjamin Franklin canvassed the colonies in an effort to establish an institution for promoting useful knowledge among the British plantations in America, to be called The American Philosophical Society, with a publication to be called the *American Philosophical Miscellany*. The society and the publication which it was planned to issue, giving the latest information on scientific subjects, failed, for the colonies were apparently not yet prepared for such inno-

vations. In 1766 another effort was made, resulting in the founding of The American Philosophical Society for the Promotion of Useful Knowledge, which is still active, and of which your own Thomas Jefferson was president from 1797 to 1815, a period of eighteen years.

The thought of a scientific body to aid the government was persistent. Washington again brought the idea to the front in his farewell address, when he said, "Promote, then, as an object of primary importance, institutions for the general diffusion of knowledge. In proportion as the structure of a government gives force to public opinions it should be enlightened." To carry his idea in part to fruition, he left in his will a bequest of $25,000 for the establishment, at the seat of government, of a national university; apparently to be primarily an institution to train men in all matters having to do with the structure of the nation. A broad interpretation of this conception of Washington has led some to believe that his thought was to make available at all times experts such as are now to be found in the membership of the National Academy of Sciences.

In 1806 in a letter to Joel Barlow (Ford Ed. VIII, 424) Jefferson advocated the affiliation of local societies with a central academy at the national capital to aid in the publication of information and to promote useful information.

Passing over a long period: the American Society of Geologists and Naturalists was founded in 1840, and in 1850 broadened its scope and became the American Association for the Advancement of Science. This body paved the way for the National Academy of Sciences, for it was at the second meeting of this body in 1851 that Alexander Dallas Bache pointed out the fact that "an institution of science, supplementary to existing ones, is much needed in our country, to guide public action in reference to scientific matters." He never lost sight of the idea, and twelve years later his efforts were finally crowned with success when, with the help of Benjamin Peirce, Louis Agassiz, Joseph Henry, Admiral Charles H. Davis and Benjamin Apthorp Gould and Senator Henry Wilson, an act was unanimously passed by Congress establishing the National Academy of Sciences.

JEFFERSONIAN "FREEDOM OF SPEECH" FROM THE STANDPOINT OF SCIENCE[1]

By Dr. ISAIAH BOWMAN

PRESIDENT OF THE JOHNS HOPKINS UNIVERSITY

IN a panel over the dais in the main hall of the National Academy of Sciences at Washington there are displayed portions of the text of Aeschylus's "Prometheus Bound," which recite Prometheus's gifts to man. Permit me to recall to your minds the setting of that drama and point out its relation to our theme.

To punish Prometheus for his audacity in carrying the gift of fire to men and thus bestowing on them the power of gods, two aides named Might and Violence, acting under the mandate of angry Zeus, rivet Prometheus's chains to a rock where, as the story runs, "the anguish of thy state shall gnaw thy heart forover. . . ." Hephaestus thought Zeus implacable and dared to say, "Harsh is every king whose power is new." In answer to the lamentations of the Chorus, Prometheus states his case. He found man "witless as a babe." Though they had eyes, men saw in vain; though they had ears, they heard not; they confounded all things; and they had their dwelling like the ant in subterranean caves, living without token of the winter's cold or "herald of the flowery spring." Prometheus revealed to them

> . . . the obscure
> Risings and settings of the stars of heaven.
> Yea, and the art of number, arch-device,
> I founded, and the craft of written words . . .
> And none but I devised the mariner's car
> On hempen wing roaming the trackless ocean.
>
> . . . if a man fell sick,
> There was no remedy, nor shredded herb
> Nor draught to drink nor ointment . . . until I
> Revealed the blends of gentle medicines
> Wherewith they arm themselves against disease.

When he bestowed fire and the related arts on man, Prometheus at the same time "implanted in his heart blind hopes," because he pitied man; and for this he must endure the tortures of Zeus, albeit defiantly, with "barbed and bitter words." Appalled by his audacity the Chorus asks: "Hast thou no fear to hurl such menaces?" Prometheus replies, "What would I fear predestined not to die?" The Chorus admonishes: "Nay thou art bold . . . and too unbridled is thy tongue."

> . . . new the rulers . . . throned above in heaven and
> the laws of Zeus are new, framed for a harsh dominion.[1]

[1] Address at the dinner of the National Academy of Sciences, Charlottesville, Virginia, November 19, 1935.

[1] Quotations from Aeschylus, "The Prometheus

In this ancient story is dramatized the play of forces that have swirled about the mind and soul of man doubtless from the time that he emerged from those "dwelling like the ant in subterranean caves." Could he go forward in the development of the arts with a free mind or must every advance be paid for in torture, and every stroke of daring end in heavier shackles? The building of the National Academy of Sciences in which this theme is displayed for the benefit of the public is but twelve years old. In those twelve years new rulers have been throned in heaven, Zeus has proclaimed new laws, and men are asking on all sides if their intent is a harsh dominion. For the fire brought down from heaven has been placed in the hands of all men and some play with it among the powder barrels, others would apply it to the arts. Some would enchain the discoverers for their impudence, others dare to proclaim new discoveries that may lead man to yet higher fields of material and spiritual conquest.

The lines in the Academy building have a vital meaning even to-day. They are not a mere archaic description of man's release from the consequences of his own ignorance. Let us inquire as to the modern forms in which this unending drama is cast. I presume it was this general theme that your committee had in mind in asking me to say something on "freedom of speech" and on the philosophy of the founder of the University of Virginia in relation thereto. Permit me to inquire, in the mode of Aeschylus, who is Zeus to-day, who the Chorus and what new chains Might and Violence may be forging wherewith to restrain within the "wintry glen" him who dares to discover a new art or defend man's right to the free use of existing arts in the promotion of human welfare?

Shall we agree that only men who have the courage to be free deserve freedom? For to enjoy the gifts of Prometheus is to share in his risks and, it may be, in his penalties. Nowadays man exercises the power of the gods, attempts to rule himself, hurls the thunderbolt, devises new arts; but in doing so he forges also his own chains and can cry neither in agony or menace to a Zeus. Once possessed of fire, magic melted away and to-night there is none of it left anywhere, at least in these United States, except perhaps in that city on the Potomac named ironically after a man who began life as a surveyor trained in the use of instruments of precision!

Jefferson's philosophy is not summed up in a sweeping declaration that we may quote as a rule of life to-day. We all know that he had what we should now call a scientific mind. His writings show clearly that he saw both the dangers that lurk in, and the liberties that spring out of, the exercise of freedom of speech and that he foresaw almost prophetically what these dangers and liberties meant of progress or retrogression in the future of the American people. His arguments are as nicely balanced as if he spoke not before but after the event. He held that freedom of the press is one of the essentials of representative government and "the school in which [men] might begin to learn the exercise of civic duties as well as rights." Though he had made the Declaration of Independence say that all men are born free and equal, he later pointed out that some people are still children and "should not be granted at once the full enjoyment of their natural rights."[2] While he thought self-government an established fact in the United States, he also thought it should remain for other peoples a reward to be obtained after a long and painful process of education. Disastrous experiment and much suffering he saw associated with the effort of some peoples to reach a point in their political evolution where they could enjoy the blessings that he considered already won for the American people.

To Jefferson the people have the government that they deserve and, if they seek improvements, these can come only through improvement of the moral qualities of every citizen—from within and not from without.

> . . . he had warned [his friends] against inflation, he opposed the formation of societies which might become so strong as "to obstruct the operation of the government and undertake to regulate the foreign, fiscal, and military as well as domestic affairs." This might be taken already as a warning against lobbying. He was fully aware that a time might come when the speeches of the Senators and Representatives "would cease to be read at all" and when the Legislature would not enjoy the full confidence of the people. He deplored the law vacating nearly all the offices of government every four years, for "it will keep in constant excitement all the hungry cormorants for office, render them as well as those in place sycophants to their Senators, engage in eternal intrigue to turn out and put in another, in cabale to swap work, and make of them what all executive directories become, mere sinks of corruption and faction."[3]

Freedom of speech Jefferson saw as a form of freedom necessarily connected with enlightenment: popular education thus becomes a necessity in a democracy. America had innate good sense, thought Jefferson, because the people had always been free. It was to that good sense that he turned for comfort under the attacks of his enemies, to which he was peculiarly

Bound," translation by George Thomson, 1932, Cambridge University Press.

[2] Quotation from Professor Gilbert Chinard, in "Thomas Jefferson, the Apostle of Americanism," 1929, page 501. Other quotations from Jefferson in this paper are from the same source.

[3] Chinard, 502.

sensitive. He strongly believed that sooner or later public opinion would do him justice and trusted that in spite of temporary errors the people, if properly educated, would distinguish between truth and falsity. This was the creed of a political philosopher, of a practical idealist, and also to some extent the creed of a gentleman. In his Revision of the Laws of Virginia, in 1779, Jefferson wrote: " . . . truth is . . . the proper and sufficient antagonist to error, and has nothing to fear from the conflict unless by human interposition disarmed of her natural weapons, free argument and debate; errors ceasing to be dangerous when it is permitted freely to contradict them."

He regretted that the Constitution, as originally adopted, did not recognize formally the freedom of the press.[4] He looked upon the press as an engine of power and held that "every man must lay his purse and his pen under contribution" in order that the public might become better informed. He opposed the monarchizing of the Constitution. Said he: "I am for a government rigorously frugal and simple, applying all the possible savings of the public revenue to the discharge of the national debt; and not for a multiplication of officers and salaries merely to make partisans." He stood for "freedom of the press, and against all violations of the Constitution to silence by force and not by reason the complaints of criticism, just or unjust, of our citizens against the conduct of their agents. And I am for encouraging the progress of science in all its branches; and not for raising a hue and cry against the sacred name of philosophy."

His reference to science was not merely a passing gesture. He predicted in that field limitless discoveries and coupled "freedom and science" as conditions of progress, having "sworn upon the altar of God eternal hostility against every form of tyranny over the mind of man." The matter was one that drew forth his most intense feelings, for he believed the American people endowed with superior wisdom, strength and opportunities.

We recall these convictions and sentiments of Thomas Jefferson, not because he was an infallible guide nor because he had the wisdom to extol freedom of thought and expression, but rather because time has proved that he was one of the great thinkers in the troubled beginnings of this nation when science was but an infant and a whole people needed guidance in the enjoyment of liberties newly won. It has been said that great causes have a "fearful frailty." Wise indeed are the far-seeing men who recognize both that greatness and that frailty and spend their strength accordingly. We recall his words at this time also because he was the founder of this university at which we have met, an institution that would not be in the university tradition if it had started its work blind to the scientific possibilities of that day or restricted by small-minded considerations. The edifice that he began men are still building, with little change in design, for many of the truths that he expounded are eternally true. Finally we recall his words, his advice and his point of view at this place and time, because the demon of intolerance is once more raising its head.

If you have thought that the cry of freedom that has been raised by scientific men and institutions is but a minor issue of the times, I venture to say that you will not long be so persuaded. That high-sounding phrase, "the oath of allegiance," is but the forerunner of other seductive phrases that represent an assault on freedom and the debasement of democratic idealism in the very terms of the charter of democracy. Confident of their strength, forces are gathering to push still further the intolerance against which Jefferson warned the people of his day. A victory for intolerance is but the signal for a fresh assault. The assault is upon one of our principles of which we should be proudest: essential freedom within the framework of public good. In 1934 I visited a number of Central European cities and in one of them strolled under an archway in a public building. Suddenly I was confronted by an armed guard and peremptorily told to take off my hat. When I inquired why I should do so, I was told that I had come within a certain statutory distance of the tomb of the Unknown Soldier, which happened to be still invisible to me from where I stood. Back and forth strode the soldier accosting people in the roughest terms and standing by to see to it that they uncovered at his command to do "honor" (God save the mark!) to the Unknown Soldier.

What a contrast is presented in London where streaming crowds pass all day the Cenotaph that stands in the midst of Whitehall. Perhaps 40 per cent. of those who pass uncover their heads and glance toward that beautiful symbol of British sacrifice. No one stops to ask of the other 60 per cent. why they pass by with apparent unconcern. In that country they deem it no man's business to ask. Perhaps the passerby has already saluted the Cenotaph a half dozen times that day. Perhaps it is the first time that he has failed to salute it in a month. Whatever the reason, no one thinks of questioning the other man's performance and no armed guard stands by. In such a people the salutations to the Unknown Soldier are from the heart. Each salute is counted an honor and a tribute, not mere reluctant obedience to a rude command.

Jefferson lived in another economy and although troubled by falsehood he could not see or foresee the

[4] In a letter to Colonel Humphreys dated 1789.

varied forms of mendacity of this complex day. The weaknesses of democracy only temporarily dimmed his bright dream of its vast possibilities if it but maintained its hold on reason and cultivated a scientific attitude of mind. How far has science really affected the public mind in matters requiring experimentation, objectivity and truth wrung from slowly accumulated facts? We are willing to concede the power of an individual to approach closely to the ideal in these respects, though when the inquiry concerns the behavior of man we sometimes hear even eminent scientists expressing opinions upon social and economic questions with the abandon and positiveness of the multitude. While Jefferson thought that the people are right in most cases he also thought them weak in that they were apt to be swayed by temporary interests and considerations and to express their lack of stability in contradictory laws. To remedy this he proposed a twelvemonth interval between the engrossing of a bill and the passing of it, or its passage in shorter time only by a two thirds vote of both houses.

We do not return to the words and wisdom of the men of an earlier day for exact or detailed guidance but for principle and for confirmation of judgment. A part of that wisdom consists in judging the times aright, in foresight and in the adaptation of the means at hand to high ends. We live not in former times but in *these* times. The current is swifter and broader now and the cross-currents are more complex. In common with the men of those times we have need, now greater than ever, for science as a mode of approach to current social problems and not as science only. Perhaps some day we shall have a meeting of the Academy to give consideration to the relation of science to the public and of ourselves in relation to society. Eventually we might even attempt at least a rough chart of certain shoals and rocks and false lights.

It was the combination of the practical and the ideal that gave an individual stamp to the thought and practice of Jefferson. This gives great weight to-day to many of his observations on the perils to principle in a democracy. What he said of the new South American republics he had said and thought of that United States that seemed to him to be destined for the high-road of liberty: they must become "trained by education and habits of freedom to walk safely by themselves"; and freedom of the press he named as one of the five essentials of free government. Knowledge in the general mass of the people, security of person and property—these are the antecedents of a capacity to estimate the value of freedom. If only a "liberty" of sorts takes root among an unprepared people, it may be tyranny still "of the many, the few, or the one."

Fire and light came to men not by one gift in a moment of time. It came and still comes into the minds and the experiences of men in an unending stream. Prometheus is a symbol of an eternal creative process. Might and Violence—the two strong-arm men who, with the aid of the implements of Hephaestus and at the command of Zeus, chained Prometheus to the rock—they too are eternal. Every man who puts fire and light into the hands of men puts also beside them a wrath and a violence, a gift and its penalty. The legislative bodies of more than a score of states have passed, or have had presented to them, bills requiring, in what Prometheus called the "craft of written words," an oath of allegiance from teachers or students or both. The flag salute controversy follows naturally. An armed soldier to tell you when to take off your hat will follow just as naturally. This is the antithesis of that "habit of freedom" which Jefferson extolled. It is the coercion of a people by fanatics, the tyranny of "the few" that Jefferson feared, the wrath of Zeus against any who would school "the race of men in every art" including the art of freedom.

In the Pythagorean mythology the primeval monsters were cleared away by Heracles, and wisdom in the person of Athena perfected the destinies of men. These are the parts of the play now in progress. For the slaying of the monsters every man is equipped with a spear called speech whose shaft is any agency that disseminates useful knowledge; and to the perfecting of our destiny we can bring united wisdom through consultation and unflinching devotion to the ideals that should animate science with respect to responsibility for public enlightenment. To-day the threat to freedom in scientific inquiry takes on a new guise. Government has taken advantage of our perilous need to give direction to the education of youth through the expenditure of public funds administered by men who are but sounding boards for political leaders. These men are not being trained as interpreters of science. Politics is training them. Let this menacing movement grow and the scientific approach is gone and scientific ideals will be not merely weakened but lost. Cast these ideals aside and lose the power to maintain our freedom through reason and the last devotee of science will be an epigrapher bending over slabs of stone and interpreting the ruins of what was once a temple of science known as the National Academy. At length he makes out a word which he pronounces "grandeur," a part of Aristotle's lines on truth that now greets the visitor as he looks upward at the frieze of that noble façade. Reflecting on the meaning of "grandeur" and on the vanity of men he will be led at length to inquire how that high enterprise of the Academicians was lost after so fair a beginning.

THOMAS JEFFERSON AS A PALEONTOLOGIST*

By the late Professor HENRY FAIRFIELD OSBORN

ASKED to mention the men of most outstanding ability who have been President of the United States, I should immediately name George Washington, Thomas Jefferson, Abraham Lincoln, Theodore Roosevelt and Woodrow Wilson. Of these, Thomas Jefferson is of particular interest to me because of his deep preoccupation with the natural sciences; as he phrased it, "the tranquil pursuits of science . . . my supreme delight." Unsurpassed in economics, ranking in power of expression with Lincoln and in culture and education with Woodrow Wilson, whom he surpassed in achievement as a promoter of the various branches of education, from the ungraded rural schools to the great university, Jefferson was a pioneer in the natural sciences and specifically in paleontology. Theodore Roosevelt alone of our presidents rivaled him in his love of the subject.

Actual comparison of these two men is impossible in the light of the vastly different scientific development of their respective periods, yet to both of them paleontology was a relaxation and a satisfaction. Jefferson retreated to it in the bitter controversy roused by his embargo policy in 1806; Roosevelt during his struggles with the New York police department almost a century later, at which time he likened the local politicians to the ancient types of creodonts and carnivores! In studying the life of Jefferson I am constantly impressed with his likeness to Theodore Roosevelt. They were the only two naturalists, or even nature-lovers, who filled our presidential chair. Roosevelt had the greater opportunity; Jefferson was the greater genius. Roosevelt lived in the full tide of modern paleontology; Jefferson lived (1743–1826) before the science of paleontology was even born and died four years before the famous conversations between Cuvier and Geoffroy St. Hilaire defined the science.

In Europe, when Jefferson was a young man, astronomy was the eldest of the sciences, while physics and chemistry were about on a par. Lavoisier, born in the same year as Jefferson, was destined to overthrow the phlogistic doctrine that had dominated the development of chemistry for over a century; his quantitative work appealed mostly to physicists but eventually won recognition by chemists, and his doctrines were spread widely through his "Traite élémentaire de chimie" (1789).

Buffon, a man of great genius, was the foremost zoologist of the time, to whom all the world looked for authoritative utterances, but long before Jefferson came to know him Buffon had retreated from his advanced evolutionary position of 1766 under pressure from the theological faculty of the University of Paris. In his later period he confined his investigations within the limits prescribed by an orthodox belief in the absolute fixity of species. Thomas Jefferson was seventeen years of age when the noted French naturalist advanced his belief in the frequent mutability of species under the direct action of environment: "How many species, being perfected or degenerated (*dénaturées*) by the great changes in land and sea, by the favors or disfavors of nature, by food, by the prolonged influences of climate, contrary or favorable, *are no longer what they formerly were,*" declared Buffon, and he continued: "One is surprised at the rapidity with which species vary, and the facility with which they lose their primitive characteristics in assuming new forms." Jefferson apparently never took up the evolution question in his study of "antiquities" but confined himself to the acquisition of bones and the straightforward description of species. He felt the time was not ripe for theories and he stated his position regarding speculation,[1] once and for all, in 1787:

> [Paris, September 20, 1787. To Charles Thompson.] I thank you also for the extract of the letter you were so kind as to communicate to me, on the antiquities found in the western country. I wish that the persons who go thither would make very exact descriptions of what they see of that kind, without forming any theories. The moment a person forms a theory, his imagination sees, in every object, only the traits which favor that theory. But it is too early to form theories on those antiquities. We must wait with patience till more facts are collected.

It is not surprising that Thomas Jefferson, when he lived in Paris (1784–1789), sought the acquaintance of Buffon; Paris was then the center of the sciences of zoology and botany, and Buffon was at the height of his career. It *is* surprising that Jefferson had both the knowledge and the courage to combat Buffon's idea that the Old World mammals had degenerated, or become *dénaturé,* in the supposedly adverse influence of the American climate. In his "Notes on the State of Virginia" (1781),[2] published privately in

* Address prepared to be read at the dinner of the National Academy of Sciences, Charlottesville, Va., November, 1935; presented in summarized form by Professor W. B. Scott, Princeton University.

[1] "The Writings of Thomas Jefferson," Library Edition, issued under the auspices of the Thomas Jefferson Memorial Association of the United States, Washington, D. C., 1903. Unless otherwise noted, all the quotations herein are taken from this source.

[2] "Notes on the State of Virginia," by Thomas Jefferson. Published by H. C. Carey and I. Lea, Philadelphia, 1825, pp. 57–65.

Paris, he took up the opinions advanced by the Comte de Buffon:

1. That the animals common to both the old and new worlds, are smaller in the latter. 2. That those peculiar to the new are on a smaller scale. 3. That those which have been domesticated in both, have degenerated in America; and 4. That on the whole it exhibits fewer species. And the reason he thinks is, that the heats of America are less; that more waters are spread over its surface by nature, and fewer of these drained off by the hand of man. In other words, that *heat* is friendly, and *moisture* adverse to the production and developement of large quadrupeds.

Jefferson opened his critique of this theory of Buffon's with a study of the relative influence of heat and moisture in the production and development of animals and worked backwards to a refutation of Buffon's premises as to relative size of the animals. In order to illustrate his points convincingly, he took time from his pressing duties in the negotiation of commercial treaties to write to various friends at home, asking for animal skins and skeletons. In 1787 he was gratified to receive the skeleton of a moose that had been procured for him by friends in Vermont and shipped to him in Paris; although he thought the cost of fifty pounds a little high, he none the less sent it off triumphantly to Buffon:

[Paris, October 3, 1787. To Monsieur Le Comte de Buffon.] I had the honor of informing you some time ago, that I had written to some of my friends in America, desiring they would send me such of the spoils of the moose, caribou, elk and deer, as might throw some light on that class of animals; but more particularly, to send me the complete skeleton, skin and horns of the moose, in such condition as that the skin might be sewed up and stuffed on its arrival here. I am happy to be able to present to you at this moment, the bones and skin of a moose, the horns of another individual of the same species, the horns of the caribou, the elk, the deer, the spiked horned buck, and the roebuck of America.

In developing his scientific opinions Jefferson at first quoted the current traditions; later he became a more serious and independent investigator. In 1781[3] he wrote about the mastodons as follows:

Our quadrupeds have been mostly described by Linnaeus and Mons. de Buffon. Of these the mammoth, or big buffalo, as called by the Indians, must certainly have been the largest. Their tradition is, that he was carnivorous, and still exists in the northern parts of America. A delegation of warriors from the Delaware tribe having visited the governor of Virginia, during the revolution, on matter of business, after these had been discussed and settled in council, the governor asked them some questions relative to their country, and among others, what they knew or had heard of the animal whose bones were found at the Saltlicks on the Ohio. Their chief speaker immediately put himself into an attitude of oratory, and with a pomp suited to what he conceived the elevation of his subject, informed him that it was a tradition handed down from their fathers, "That in ancient times a herd of these tremendous animals came to the Big-bone licks, and began an universal destruction of the bears, deer, elks, buffaloes, and other animals which had been created for the use of the Indians: that the Great Man above, looking down and seeing this, was so enraged, that he seized his lightning, descended on the earth, seated himself on a neighboring mountain, on a rock of which his seat and the print of his feet are still to be seen, and hurled his bolts among them till the whole were slaughtered, except the big bull, who presenting his forehead to the shafts, shook them off as they fell; but missing one at length, it wounded him in the side; whereon, springing round, he bounded over the Ohio, over the Wabash, the Illinois, and finally over the great lakes, where he is living at this day." It is well known, that on the Ohio, and in many parts of America further north, tusks, grinders, and skeletons of unparalleled magnitude, are found in great numbers, some lying on the surface of the earth, and some a little below it. . . . It is remarkable that the tusks and skeletons have been ascribed by the naturalists of Europe to the elephant, while the grinders have been given to the hippopotamus, or river horse. Yet it is acknowledged, that the tusks and skeletons are much larger than those of the elephant, and the grinders many times greater than those of the hippopotamus, and essentially different in form.

The term "mammoth," derived from the Siberian vernacular "mammut," was in common use in the eighteenth century for the woolly mammoth (named *Elephas primigenius* by Blumenbach in 1799) and was recognized by Camper and other naturalists to describe practically the same animal as the American mastodon (named *Elephas americanus* by Kerr in 1792); it was not considered possible that nature had produced two such widely different animals as the mastodon and the true mammoth of Asia.

The rapid development of Jefferson's views is shown in a comparison of his rather rudimentary ideas of 1781 with his later observations:

[November 26, 1782. To Mr. Steptoe.] I received in August your favor, wherein you give me hopes of being able to procure for me some of the big bones. I should be unfaithful to my own feeling, were I not to express to you how much I am obliged by your attention to the requests I made you on that subject. A specimen of each of the several species of bones now to be found, is to me the most desirable objects in natural history.

[Paris, July 17, 1785. To Dr. Styles.] I thank you for your information as to the great bones found on the Hudson river. I suspect that they must have been of the same animal with those found on the Ohio; and, if so,

[3] *Loc. cit.*

they could not have belonged to any human figure, because they are accompanied with tusks of the size, form, and substance, of those of the elephant. I have seen a part of the ivory, which was very good. The animal itself must have been much larger than an elephant.

[Paris, October 13, 1785. To Hogendorp.] I have never yet seen Monsieur de Buffon. He has been in the country all the summer. I sent him a copy of the book [Notes on Virginia], and have only heard his sentiments on one particular of it, that of the identity of the mammoth and elephant. As to this, he retains his opinion that they are the same.

[Philadelphia, May 2, 1797. To Louis, Prince of Parma.] Permit me to pay my personal tribute to science and to your Royal Highness's disposition to promote it, by depositing in your cabinet a tooth of the great animal called in Europe the mammoth, of which we find remains in the interior and uninhabited parts of this country; their great distance from us renders them rare and difficult to be obtained.

[Washington, December 14, 1800. To Robert R. Livingston.] I have heard of the discovery of some large bones, supposed to be of the mammoth, at about thirty or forty miles distance from you; and among the bones found, are said to be some of which we have never been able to procure. The first interesting question is, whether they are the bones of the mammoth? The second, what are the particular bones, and could I possibly procure them? The bones I am most anxious to obtain, are those of the head and feet, which are said to be among those found in your State, as also the ossa innominata, and the scapula. Others would also be interesting, though similar ones may be possessed, because they would show by their similarity that the set belongs to the mammoth. Could I so far venture to trouble you on this subject as to engage some of your friends near the place, to procure for me the bones above mentioned? If they are to be bought I will gladly pay for them whatever you shall agree to as reasonable.

[Washington, February 3, 1801. To Dr. Caspar Wistar.] According to your desire I wrote to Chancellor Livingston on the subject of the bones. The following is an extract from his letter dated January 7th: "I have paid the earliest attention to your request relative to the bones found at Shawangun, and have this day written to a very intelligent friend in that neighborhood. I fear however that till they have finished their search, there will be some difficulty in procuring any part of the bones, because when I first heard of the discovery I made some attempts to possess myself of them, but found they were a kind of common property, the whole town having joined in digging for them till they were stopped by the autumnal rains. They entertain well-grounded hopes of discovering the whole skeleton, since these bones are not, like all those they have hitherto found in that County, placed within the vegetable world, but are covered with a stratum of clay,—that being sheltered from the air and water they are more perfectly preserved. Among the bones I have heard mentioned, are the vertebra, part of the jaw, with two of the grinders, the tusks, which some have called the horns, the sternum, the scapula, the tibia and fibula, the tarsus and metatarsus. Whether any of the phalanges or innominata are found, I have not heard. A part of the head containing the socket of the tusks is also discovered. From the bones of the feet, it is evidently a claw-footed animal, and from such parts of the shoulder bones as have been discovered, it appears that the arm or fore-leg, had a greater motion than can possibly belong to the elephant or any of the large quadrupeds with which we are acquainted. Since bog-earth has been used by the farmers of Ulster county for a manure, which is subsequent to the war, fragments of at least eight or ten have been found, but in a very decayed state in the same bog."

From this extract, and the circumstance that the bones belong to the town, you will be sensible of the difficulty of obtaining any considerable portion of them. I refer to yourself to consider whether it would not be better to select such only of which we have no specimens, and to ask them only. It is not unlikely they would with common consent yield a particular bone or bones, provided they may keep the mass for their own town. If you will make the selection and communicate it to me, I will forward it to the Chancellor, and the sooner the better.

[Washington, February 25, 1807. To Dr. Caspar Wistar.] I enclose you a letter from Dr. Goforth on the subject of the mammoth. Immediately on the receipt of this, as I found it was in my power to accomplish the wishes of the society for the completion of this skeleton with more certainty than through the channel proposed in the letter, I set the thing into motion, so that it will be effected without any expense to the society, or other trouble than to indicate the particular bones wanting. Being acquainted with Mr. Ross, proprietor of the Big Bone lick, I wrote to him for permission to search for such particular bones as the society might desire, and I expect to receive it in a few days. Captain Clarke (companion of Captain Lewis) who is now here, agrees, as he passes through that country, to stop at the lick, employ laborers, and superintend the search at my expense, not that of the society, and to send me the specific bones wanted, without further trespassing on the deposit, about which Mr. Ross would be tender, and particularly where he apprehended that the person employed would wish to collect for himself. If, therefore, you will be so good as to send me a list of the bones wanting (the one you formerly sent me having been forwarded to Dr. Brown), the business shall be effected without encroaching at all on the funds of the society, and it will be particularly gratifying to me to have the opportunity of being of some use to them. But send me the list if you please without any delay, as Captain Clarke returns in a few days, and we should lose the opportunity.

[Washington, December 19, 1807. To Dr. Caspar Wistar.] I have lately received a letter from General Clarke. He has employed ten laborers several weeks, at the Big-bone Lick, and has shipped the result in three large boxes, down the Ohio, via New Orleans, for this place, where

they are daily expected. He has sent, 1st, of the Mammoth, as he calls it, frontals, jaw bones, tusks, teeth, ribs, a thigh, and a leg, and some bones of the paw; 2nd, of what he calls the Elephant, a jaw bone, tusks, teeth, ribs; 3d, of something of the buffalo species.

[Washington, March 20, 1808. To Dr. Caspar Wistar.] Between Philadelphia and this place is but two days, and the roads are already fine. I would propose, therefore, that you should come a few days before Congress rises, so as to satisfy that article of your curiosity. The bones are spread in a large room, where you can work at your leisure, undisturbed by any mortal, from morning till night, taking your breakfast and dinner with us. It is a precious collection, consisting of upwards of three hundred bones, few of them of the large kinds which are already possessed. There are four pieces of the head, one very clear and distinctly presenting the whole face of the animal. The height of his forehead is most remarkable. In this figure, the indenture at the eye gives a prominence of six inches to the forehead. There are four jaw bones, tolerably entire, with several teeth in them, and some fragments; three tusks like elephants; one ditto, totally different, the largest probably ever seen, being now from nine to ten feet long, though broken off at both ends; some ribs; an abundance of teeth studded, and also of those of the striated or ribbed kind; a fore-leg complete; and then about two hundred small bones, chiefly of the foot. This is probably the most valuable part of the collection, for General Clarke, aware that we had specimens of the larger bones, has gathered up everything of the small kind. There is one horn of a colossal animal. The bones which came do not correspond exactly with General Clarke's description; probably there are some omissions of his packers. Having sent my books to Monticello, I have nothing here to assist you but the "Encyclopedie Methodique."

[Washington, July 14, 1808. To Monsieur de la Cepede.] If my recollection does not deceive me, the collection of the remains of the animal incognitum of the Ohio (sometimes called mammoth), possessed by the Cabinet of Natural History at Paris, is not very copious. Under this impression, and presuming that this Cabinet is allied to the National Institute, to which I am desirous of rendering some service, I have lately availed myself of an opportunity of collecting some of these remains. General Clarke (the companion of Governor Lewis in his expedition to the Pacific Ocean) being, on a late journey, to pass by the Big-bone Lick of the Ohio, was kind enough to undertake to employ for me a number of laborers, and to direct their operations in digging for these bones at this important deposit of them. The results of these researches will appear in the enclosed catalogue of specimens which I am now able to place at the disposal of the National Institute.

[Monticello, September 10, 1809. To General William Clarke.] The three boxes of bones which you had been so kind as to send to New Orleans for me, as mentioned in your letter of June 2d, arrived there safely, and were carefully shipped by the collector, and the bill of lading sent to me. But the vessel put into Havana, under embargo distress, was there condemned as unseaworthy, and her enrollment surrendered at St. Mary's. What was done with my three boxes I have not learned, but have written to Mr. Brown, the collector, to have inquiry made after them. The bones of this animal are now in such a state of evanescence as to render it important to save what we can of them. Of those you had formerly sent me, I reserved a very few for myself; I got Dr. Wistar to select from the rest every piece which could be interesting to the Philosophical Society, and sent the residue to the National Institute of France. These have enabled them to decide that the animal was neither a mammoth nor an elephant, but of a distinct kind, to which they have given the name of Mastodont, from the protuberance of its teeth. These, from their forms, and the immense mass of their jaws, satisfy me this animal must have been arboriverous. Nature seems not to have provided other food sufficient for him, and the limb of a tree would be no more to him than a bough of a cotton tree to a horse.

These studies of the mammoth were carried on mostly in an unfurnished room of the White House itself during the trying political time of 1801 when Congress was struggling to untangle the confusion resulting from a presidential vote, tied between Jefferson and Burr. Jefferson retreated from the storm to contemplate the mysteries of nature. Five years later, when the country was in an uproar and every day brought fresh denunciation of the presidential embargo policy, Jefferson managed to make intervals in his crowded days for scientific research; this conduct aroused bitter ridicule among his countrymen, to whom science meant atheism. William Cullen Bryant, then a child of thirteen, reflected the popular disgust in a satirical poem entitled "The Embargo," which was later suppressed. He wrote in part:

> Go, wretch, resign thy presidential chair,
> Disclose thy secret measures, foul or fair,
> Go, search with curious eyes for horned frogs,
> 'Mid the wild wastes of Louisianian bogs;
> Or where the Ohio rolls his turbid stream
> Dig for huge bones, thy glory and thy theme.

In 1796 Jefferson came into possession of the bones of the so-called *Megalonyx Jeffersoni,* or great claw. His observations of this creature were characteristic:

[Monticello, November 10, 1796. To Colonel John Stuart.] I have to acknowledge the receipt of your last favor, together with the bones of the great claw, which accompanied it. My anxiety to obtain a thigh bone is such, that I defer communicating what we have to the Philosophical Society, in the hope of adding that bone to the collection. We should then be able to fix the stature of the animal, without going into conjecture and calculation, as we should possess a whole limb, from the haunch

bone to the claw inclusive. However, as you announce to me that the recovery of a thigh bone is desperate, I shall make the communication to the Philosophical Society. I think it happy that this incident will make known to them a person so worthy as yourself to be taken into their body, and without whose attention to these extraordinary remains, the world might have been deprived of a knowledge of them. I cannot, however, help believing that this animal, as well as the mammoth, are still existing. The annihilation of any species of existence, is so unexampled in any parts of the economy of nature which we see, that we have a right to conclude as to the parts we do not see, that the probabilities against such annihilation are stronger than those for it. In hopes of hearing from you, as soon as you can form a conclusion satisfactory to yourself, that the thigh bone will or will not be recovered, I remain, etc.

[Monticello, January 22, 1797. To Dr. Benjamin Rush.] I am indebted to the Philosophical Society a communication of some bones of an animal of the lion kind, but of most exaggerated size. What are we to think of a creature whose claws were eight inches long, when those of the lion are not 1½ inches; whose thigh-bone was 6¼ diameter; when that of the lion is not 1½ inches? Were not the things within the jurisdiction of the rule and compass, and of ocular inspection, credit to them could not be obtained. I have been disappointed in getting the femur as yet, but shall bring on the bones I have, if I can, for the Society, and have the pleasure of seeing you for a few days in the first week of March. I wish the usual delays of the publications of the Society may admit the addition to our new volume, of this interesting article, which it would be best to have announced under the sanction of their authority.

[Monticello, August 15, 1797. To Colonel John Stuart.] On my arrival at Philadelphia, I met with an account published in Spain of the skeleton of an enormous animal from Paraguay, of the clawed kind, but not of the lion class at all; indeed, it is classed with the sloth, ant-eater, etc., which are not of the carnivorous kinds; it was dug up 100 feet below the surface, near the river La Plata. The skeleton is now mounted at Madrid, is 12 feet long and 6 feet high. There are several circumstances which lead to a supposition that our megalonyx may have been the same animal with this. There are others which still induce us to class him with the lion. Since this discovery has led to questioning the Indians as to this animal, we have received some of their traditions which confirm his classification with the lion. As soon as our 4th volume of transactions, now in the press, shall be printed I will furnish you with the account given in to the Society. I take for granted that you have little hope of recovering any more of the bones. Those sent me are delivered to the Society.

The bones were later transferred to the Academy of Natural Sciences at Philadelphia, where they may still be seen.

In 1797 Jefferson was elected president of the American Philosophical Society at Philadelphia and read his first paper on paleontology—a description of the *Megalonyx*. He compared the great fossil claws with those of a lion and concluded that the creature was probably of that species. He was rather in a quandary as to the fate of the great claw, and remarked:

> . . . In the present interior of our continent there is surely space enough . . . for mammoths and Megalonyxs who may exist there. . . . Our entire ignorance of the immense country to the west and northwest . . . does not authorize us to say what it does not contain. . . . In fine, the bones exist; therefore the animal has existed. The movements of nature are in a never-ending circle. The animal species which has once been put into a train of motions, is still probably moving in that train. For, if one link in nature's chain might be lost, another and another might be lost, till this whole system of things should vanish by piecemeal.

These were very sensible conclusions, in view of the limited knowledge of his day, and represented a truly scientific view-point. He maintained an open mind and six years later induced Dr. Samuel Latham Mitchill, professor of geology at Columbia College and United States Senator, to translate into English Cuvier's "Theory of the Earth."

While pursuing the fascinations of paleontological research, Jefferson arranged for Congress to authorize the expedition of Lewis and Clark to the unknown headwaters of the Missouri River and in 1806 sent Pike to discover the peak which bears his name. He selected these explorers with meticulous attention to their training, their physical and mental fitness, their accuracy of observation, their courage, resourcefulness and ability to deal with the Indians. He planned their equipment and the preservation of their records and paid a large part of their expenses from his own funds. Thus were laid the foundations of the United States Geological, Coastal and Geographic Surveys, at the small cost to the nation of $2,500.

Upon his retirement from the presidency, Jefferson returned to Monticello and soon became deeply involved in the task of establishing the University of Virginia, to whose every department he gave his most minute and careful attention until the day of his death. He gradually retired from active work in science; fifteen years before he died at the age of eighty-three, he wrote (May 12, 1811) to Count John Potocki:

> Nothing would be more flattering to me than to give aid to your inquiries as to this continent, and to weave its ancient history into the web of the old world; and with this view, to accept the invitation to a correspondence with you on the subject. But time tells me I am nearly done with the history of the world. . . . I shall serve you therefore more permanently, by bequeathing to you an-

other correspondent, more able, more industrious, and more likely to continue in life than myself. Dr. Benjamin S. Barton, one of the professors of the College of Philadelphia, is learned in the antiquities of this country, has employed much time and attention on researches into them, is active and punctual, and will, I think, better fulfil your wishes than any other person in the United States. . . . He will, I am sure, set a just value on the correspondence proposed, for which I shall take care to prepare him.

ABSTRACTS OF PAPERS PRESENTED AT THE AUTUMN MEETING[1]

Giant skin growth on mammals of normal size: CHARLES R. STOCKARD. The growth of skin and the skeletal framework of the body are regulated so that they properly fit together. Size regulation in development is accomplished more largely through inhibition of unlimited growth tendencies rather than through a stimulation of resisting tissues, if there be such. Overgrowths or giant reactions in organs and tissues also, more likely, result from disturbance in conditions of growth regulation and growth inhibition than from growth-stimulating stuffs. This is well shown by the continuous growth of tissues when removed from the influences of other body parts. The skin in certain individuals may become greatly thickened and enlarged in area so that it hangs in folds and wrinkles, being too extensive to properly fit the person. Such a condition may result from diseases, and the response is as if the skin had been freed from the influence of the growth-regulating factors which still act to preserve harmonious growths among the other tissues of the body. Recently several investigators have found that the injection of extracts from the pituitary gland into young dogs may bring about an overgrowth of skin along with what appears to be a general increase in body size. This was interpreted as a response to a growth-stimulating hormone. As might be expected, the responses to these injections differed somewhat among different types of dogs. For several years we have been studying, through the hybridization of pure dog-breeds, the differences in growth reactions of various tissues and body regions in giant and dwarf animals and in breeds exhibiting localized growth anomalies. In these experiments striking structural disharmonies have arisen as a result of failure in the regulation of growth coordination and harmonious sizes among the systems of the body. Excessive growth in skin area as related to body size has been a frequent feature arising from a number of different breed crosses. Similar skin growths have arisen from internal chemical disturbances and salt deficiencies in some dogs and also as a result of infection with skin parasites. The English bulldog has a short stocky body with smooth skin but a wrinkled face, since a normal amount of skin is fitted over a much shortened and flat-faced muzzle. When the bulldog is crossed with the German shepherd, police dog, a smooth-skinned animal, the first generation hybrids, F_1, have fairly close-fitting skin on a stocky mastiff-like body. When this F_1 is bred back to the shepherd parent a shepherd-like dog with close-fitting skin results. However, the F_1 bred back on the bulldog gives an animal with bull type but with more wrinkled and looser skin than the bull: as though the skin were growing on one pattern and the body on another. The most exaggerated misfits of skin occur in crosses between bulldogs and the short-legged basset-hound. The skin on the basset is loose but not to an excessive degree. The F_1 hybrids in the bull-basset cross have a greatly exaggerated area of skin fully sufficient for a dog of double the size. This skin is not thin but unusually thick, being one quarter to almost one half inch thick on the back of the neck. It hangs in folds from the body and wrinkles along the legs. Among the F_2 hybrids of this cross some individuals have smoothly fitting skin, on others the skin is loose, while on still others there is an excessive extent of skin folding and wrinkling over the anterior parts of the body, head and legs. The looseness of the skin is more marked in some individuals in the F_2 group than in back crosses of the F_1 hybrids on either the bulldog or basset-hound stocks. The St. Bernard dog and the bloodhound as pure breeds have loose wrinkled skin chiefly over the head and front parts of the body. When these are crossed on the smooth-skin Great Dane the F_1 and F_2 hybrids in some cases show excessively loose skin but not more exaggerated than in the wrinkled parent stock. Several other breeds give the same skin reaction on crossing. All breeds with overgrowth of skin have in common other symptoms and characters which indicate that the pituitary gland is functioning in an abnormal manner: in no sense hyper-function. A study of the gross and microscopic structures of these pituitaries reveals frequent cystic conditions and very abnormal cellular proportions and arrangements. The abnormal pituitary in these dogs is further associated with abnormal reproductive processes and modified behavior of the bitch toward her puppies. There is an accumulation of evidence showing the calcium-phosphorus balance to be disturbed. In further line with these interpretations it has been found that puppies with marked rickets of the bones, although from breeds with smooth-fitting skin, may show an exaggerated looseness and folding of the skin accompanying rickets. Dogs on diets low in calcium as well as those developing rickets become most susceptible to infections with sarcoptic mange. On a low calcium diet it is most difficult to eliminate mange from the skin with what is usually an effective external treatment. Also a puppy with severe mange is unusually prone to develop rickets unless careful precautions be taken to prevent it. And many such puppies exhibit an abnormal looseness and folding of the skin. From the evidence at hand we interpret these reactions as being associated with a disturbed calcium metabolism resulting from defective pituitary-parathyroid balance. Bone and skin, having the

[1] Charlottesville, Va., November 18, 19 and 20, 1935.

highest calcium requirements of all tissues, are interrelated in these disturbances. The excessive increase in skin area, giving looseness with folds and wrinkles, is a growth reaction correlated with defective states of the pituitary gland and in most cases accompanied by modification of skeletal growth, but not necessarily with gigantism or overgrowth of the bones. Coordination in the development and growth of the body organs and parts to insure harmonious size relations is dependent upon a normal pituitary secretion. The so-called growth hormone of the pituitary is probably not simply a growth-promotive hormone but the hormone having most to do with the regulation and coordination of the growths among the many body parts. When this hormone is lacking or changed, structural disharmonies and distorted misfits of the body parts are exhibited to varying degrees.

The rôle of the lymphocyte in blood formation: H. E. JORDAN. Pigeons and chickens lack lymph nodes but possess relatively very large amounts of lymphoid tissue in bone marrow, liver and rectal ceca, much in the form of nodules with germ centers. This material is exceptionally favorable for study of the problem of the function of the small lymphocyte. These lymphocytes are identical in marrow, spleen, liver and ceca. They are daughter cells of hemocytoblasts and retain the capacity to differentiate after a certain amount of growth into erythrocytes and granulocytes. In the liver and ceca they normally develop into granulocytes. In bone marrow the lymphoid nodules constitute a stage in erythropoiesis. These nodules consist typically of a germ center of proliferating hemocytoblasts and a mantle of small lymphocytes. The lymphocytes migrate both into the adjacent venous sinuses and into the intervascular stroma, meanwhile growing in size and acquiring features similar to those of the original hemocytoblasts. Within the vascular sinuses the larger lymphocytes develop into erythrocytes, the smaller into thrombocytes; in the intervascular stroma larger lymphocytes develop into granulocytes.

The production of blood-platelets in the lungs: W. H. HOWELL. The paper describes a new technique by means of which counts may be made of the blood-platelets and the red corpuscles in the same specimen of blood. The application of this method to various arteries and veins disclosed the fact that in the arteries the number of platelets per cubic millimeter of blood is constantly higher than in the veins. This difference is accentuated after the use of experimental methods which cause a diminution in the normal platelet-count, such as defibrination of the blood or the intravenous injection of saponin or peptone. Comparisons of this kind between the artery and vein of various organs indicate that the blood in passing through the systemic capillaries loses in plates, whereas in traversing the lung capillaries the number is increased. This indication that platelets are produced in the lungs was corroborated by perfusion experiments with a platelet preserving solution. In the case of the lungs irrigation with such a medium is followed by a marked increase in the relative number of platelets. The ratio of platelets to erythrocytes increases from a ratio of about one to twenty to four or eight to one. Since similar increases were not obtained from other organs this result is interpreted to mean that a supply or storage of platelets exists in the lungs. Histological examination of the lungs of the experimental animals demonstrated for the normal animal, and to a more marked extent for those in which platelet production had been stimulated, that platelets are formed in the lungs from the cytoplasm of megacaryocytes. With the fixation and staining methods used megacaryocytes were found with cytoplasmic processes branching in the capillaries and composed entirely of the characteristic platelet material. The sections show many detached processes of platelet material in addition to numbers of normal platelets.

On the significance of the numerical relations of the fibers in the spinal nerves of the mouse, rat, dog and man: HENRY H. DONALDSON.

Cortico-adrenal influences on salt and carbohydrate metabolism: S. W. BRITTON and H. SILVETTE. Conflicting data on which various theories of cortico-adrenal function depend are possibly due to the use by different investigators of only one animal type. To obtain a broader view of the subject which might be valid for mammals in general and not alone for one form, the comparative physiological approach has been utilized. Sodium chloride and carbohydrate metabolism have been studied in a marsupial animal (the opossum, *Didelphys virginiana*) and a hibernating type (the marmot, *Arctomys monax*), the former definitely and the latter probably an ancient mammal. Carbohydrate and electrolyte studies have also been made on other animals under various experimental conditions. Opossums and marmots have been found to succumb following adrenal removal with general symptoms of insufficiency similar to those observed in higher mammalian forms. Sodium, chloride and water concentrations are, however, strikingly different: in blood serum and muscle the sodium chloride levels are increased over the normal, and muscle water is concomitantly decreased. Daily urinary output of sodium chloride is correlatively subnormal. The commoner laboratory animals (dogs, cats, etc.) show reverse effects from adrenal excision. All the mammalian types which have been examined show similar shifts in carbohydrate values after adrenalectomy: blood glucose and hepatic glycogen are reduced to levels incompatible with life, and muscle glycogen is notably decreased. Serum sodium and chloride values in different animal types suffering from adrenal insufficiency may be either increased or decreased or practically unaffected. The significance of sodium chloride and carbohydrate changes under many different experimental conditions is discussed. Hormones usually act similarly in all animal types. The life-maintaining factor in the adrenal cortex seems to affect only indirectly sodium chloride balance; it appears to be concerned directly in the regulation of carbohydrate metabolism in the organism.

On the incidence of tuberculosis in the offspring of tuberculous parents: RAYMOND PEARL. In a total of 564

matings producing 2,480 offspring the proportionate incidence of tuberculosis among the offspring was found to be in the following ratios by mating types, the incidence in the offspring from matings in which neither parent was tuberculous being taken as 1: Both parents tuberculous, 4.3; father tuberculous, mother not, 1.7; mother tuberculous, father not, 1.6; neither parent tuberculous, 1. These results suggest the inference that a person is, on the average, about four times as likely to have tuberculosis if both his parents had it than if neither parent did. Such analysis of the material as it has so far been possible to make fails to disclose any factor other than heredity playing any significant rôle in producing the observed *differential* distribution of offspring incidence of tuberculosis by mating types, in the present material.

An experimental and clinical study of cobra venom as an analgesic: DAVID I. MACHT. Reptiles and their secretions were used empirically in the primitive medicine of the ancients. Recently, in France, the venom of the cobra was introduced in therapeutics on somewhat more rational grounds. Calmette, Taguet and Monaelesser, Laignel-Lavastine and Koressios, and others have reported some remarkable effects that they observed after injecting cobra venom in cases of malignant tumor, particularly for relief of the severe pain common among patients affected with such disease. Their interesting findings prompted the present investigation. The fourfold objective of the writer's work was (1) to study the general pharmacology and toxicology of cobra venom, (2) to prepare and accurately assay biologically a sterile solution of cobra venom for therapeutic use, (3) to carry out a carefully controlled clinical investigation concerning the influence of cobra venom injections on a series of selected patients affected with malignant tumors causing severe pain; and (4) to analyze the pharmacodynamics of cobra venom action in order to ascertain its more intimate mechanism as an analgesic. Solutions of the drug in physiological saline were prepared; and its toxicity for living plants, as well as for lower and higher animals, was established. The pharmacological effect of cobra venom on the circulation, respiration, kidney function, movements of intestinal muscle, activity of enzymes and on other physiological functions was then carefully investigated. The margin of safety for higher animals having been determined, a solution of the venom in physiological saline was prepared, sterilized by a special method to avoid decomposition of the drug, and assayed biologically to furnish a preparation suitable for therapeutic administration to human beings. In collaboration with several distinguished surgeons, the writer studied a series of one hundred clinical cases affected with advanced and inoperable cancer and other malignant tumors, and suffering from such intense pain as to require the use of the most powerful narcotics and analgesics. In this series of cases, the effect of intramuscular injections of the specially prepared cobra venom was compared with that of other pain-relieving drugs. Favorable results in relieving the symptoms were obtained in seventy-five of these cases. The control of pain and improvement in general condition of some of the patients were very striking; and the cobra venom was found to be therapeutically more effective and satisfactory than morphine or other opiates, or any other drug. Pharmacodynamic studies revealed that the cobra venom, in the therapeutic doses employed, was neither a local anesthetic for ascending or descending nerve fibers, nor for sensory nerve endings; but pointed to the higher nerve centers in the cerebrum as the seat of the analgesia. This impression was confirmed and established by psychopharmacological experiments on rats trained in the circular maze, by studies on the sedative effect of cobra venom on convulsions of cerebral origin produced in animals by special pharmacological agents and by measurements of the pain threshold before and after injection of the venom in guinea pigs and in human subjects. The pharmacological data in hand indicate that the mechanism of cobra venom action as an analgesic is very much like that of morphine—with this important difference, that it is not habit-forming and does not produce the disagreeable and dangerous by-effects of the opiates.

Renal insufficiency produced by partial nephrectomy. Some factors influencing renal function: ALFRED CHANUTIN and STEPHAN LUDEWIG. The effect of feeding diets containing varying percentages (10, 20, 40 and 80) of whole meat to intact, unilaterally nephrectomized and partially nephrectomized rats has been studied. The kidney damage was progressively greater with increased protein ingestion as demonstrated by the urea (Addis) ratio and by the increased volumes of dilute urine excreted during a concentration test. In partially nephrectomized animals the blood urea and urine urea concentrations at any given urea ratio were greater, the higher the protein intake. It was found that the blood urea concentration and the urine specific gravity were good qualitative indicators for kidney function. The $\frac{\text{urea ratio}}{\text{kidney weight}}$ ratio was constant for the intact and unilaterally nephrectomized rats on all dietary groups. The value for the $\frac{\text{urea ratio}}{\text{surface area}}$ ratios increased with added increments of whole meat in the diet. These values were proportional to the degree of renal hypertrophy.

How cars go out of control: analysis of the driver's reflexes: YANDELL HENDERSON. To be published later.

Biographical memoir of William Stewart Halsted: W. G. MACCALLUM. (Read by title.)

An oscillograph with a memory: A. W. HULL. It is possible to record electrical events which happen prior to the time of opening the camera shutter, by utilizing the phosphorescence of the screen of a cathode ray oscillograph. The oscillograph is allowed to write continuously, the record fading out as fast as it is written except for the slight phosphorescent lag. With ordinary willemite screens this lag is about 1/25th of a second. If the event, which may be entirely unexpected, is made to trip the shutter of a camera set to photograph the screen, the resulting photograph will contain the record of what hap-

pened after the event, during the time the camera shutter was open, plus that which happened during the 1/25th of a second prior to the event. In this way it is possible to obtain records of disturbances, such as are back in a rectifier, which give not only the full history of the event but also the circumstances which led up to it. This instrument is being used to study the behavior of rectifiers and Thyratrons.

The production and use of high rotational speeds: J. W. BEAMS, University of Virginia (introduced by S. A. Mitchell). The use of air-driven turbines supported on air bearings to produce high rotational speeds is outlined. A few simplifications and improvements in the method[1] of spinning rotors in a vacuum as well as in gases at various pressures are described. The maximum rotational speed is limited only by the strength of the rotor. The rotor spinning at high speed in a vacuum or in gases at comparatively low pressure is shown to be suited to problems in centrifuging. Since the attainable peripheral speed of the rotor is well above the average speed of the molecules for most gases at ordinary temperatures, it may be used as a velocity selector for molecules. A method is proposed for the separation of isotopes which takes advantage of the combined separation due to centrifuging and this velocity selection. The adaptation of high-speed rotors to several other uses, such as the very rapid rotation of mirrors or the measurement of the velocity of ions and fast particles, are briefly discussed.

The optical constants and photoelectric emission of potassium: HERBERT E. IVES and H. B. BRIGGS. A theory of photoelectric emission from thin films of photo-active material on a specular metallic base, proposed some years ago,[1] predicts the photo-emission to be conditioned by the optical absorption of the photo-active material. In order to calculate this absorption a knowledge of the refractive indices and extinction coefficients of the materials involved is necessary. These data have not been available for the alkali metals, which are the most important photoelectric emitters, in the region of the spectrum which is crucial to the above theory, namely, the ultra-violet. An apparatus for polarimetric analysis has been constructed with quartz elements, and used, by the photographic method of Voigt,[2] to determine the optical constants of a layer of potassium deposited on the back of a specially selected 60° fused quartz prism. Complete data for the visible and ultra-violet spectrum have been obtained. Applying these data in the theory, a very striking agreement with experimentally determined potassium photo-emission through the spectrum is obtained. The sharply marked maximum of emission in the ultra-violet is predicted at the right wave-length, and the enormous enhancement of emission when the incident light is polarized with the electric vector parallel to the plane of incidence is an immediate consequence of the unusual optical properties of the alkali metal.

The international adoption of the Giorgi System of M. K. S. units by the International Electrotechnical Commission, June, 1935: A. E. KENNELLY.

Heights and weights of 275 public school girls in ten consecutive years: EDWIN B. WILSON.

Studies on new narcotics: LYNDON F. SMALL. In the course of a systematic search for new drugs capable of replacing morphine, many interesting variations of the morphine structure have been made, and several consistent relationships between constitution and physiological action discovered. The similarity in general physiological effect between certain of the structural and configurational isomers of morphine and codeine leads to the hypothesis that position of groups in space is more important than nuclear location of functional groups in this series. The hypothesis has been supported by results obtained with dihydropseudocodeinone and dihydroisomorphinone, isomers of Dicodid and Dilaudid, synthesized by the application of special hydrogenation technique. A functional group in the 6-position of the morphine nucleus appears to affect physiological activity to a much greater degree than the same group in the 8-position. When, however, the group at the 8-position is of such nature that it lies out of the plane of the nucleus, it may through a favorable configuration exert a physiological action greater than that of the group having an unfavorable configuration in the 6-position. By treatment of dihydrothebaine with methylmagnesium iodide, a new type of codeine derivative, containing a methyl group in the hydro-aromatic ring III has been prepared. The Grignard reagent adds at the ether linkage and the enol ether double bond of dihydrothebaine, and the enol ether group immediately undergoes hydrolysis. A phenolic ketone results, and by the action of bromine and sodium hydroxide on this ketone the 4,5-ether ring can be closed again. Reduction of the ketone group gives a codeine homolog designated as 7-methylcodeine.

(*To be continued*)

OBITUARY

WALTER HOUGH

THE United States National Museum lost one of the oldest and most highly esteemed members of its scientific staff when Dr. Walter Hough died suddenly of heart failure, in his seventy-seventh year, on September 20, 1935. Entering the service of the Museum as a copyist in January, 1886, he won advancement, through constantly increasing familiarity with museum problems and through his ready knowledge of many widely diversified subjects, to a succession of positions that culminated in his appointment as head curator, department of anthropology, on March 1, 1923. His successful administration of this latter office was recognized by three separate extensions beyond the established age for retirement of federal em-

[1] Beams and Pickels, *Rev. Sci. Inst.*, 6: 299, 1935.
[1] *Phys. Rev.*, 38: 1209, 1931.
[2] *Physik. Zeitschr.*, 2: 303, 1901.

ployees. For fifty years, lacking only three months, he was continuously in the public service.

Walter Hough was born in Morgantown, West Virginia, on April 23, 1859, the son of Lycurgus S. and Anna Fairchild Hough. As a child he was fascinated by the accounts his mother read to him of explorations in Palestine, the Near East and elsewhere. Seeking in his own way to emulate these adventures in antiquity he roamed the nearby hills and woods, discovered for himself old Indian camp sites whereon he found the arrowpoints, stone artifacts and pottery fragments that formed the nucleus of his boyhood collection. His father's library provided the inspiration that turned his enthusiasm from one youthful interest to another, but definitely fixed in his mind the idea of a career in science. Throughout his school years geology received major attention, owing, perhaps, to the sympathetic encouragement given by such eminent leaders as I. C. White, state geologist of West Virginia; William Maury Fontaine, celebrated professor of geology at the University of Virginia, and J. J. Stevenson, of New York, then a recognized authority on the geology of the coal measures of Pennsylvania and West Virginia. For Dr. Stevenson the boy Walter collected fossils from the Carboniferous formations near his home town and received, in exchange, fossils from other areas. But geology and paleontology eventually yielded to a deeper interest in primitive peoples and the rise of civilization in various parts of the world. His collection of Carboniferous plants and invertebrates, treasured since school days, was finally presented to the National Museum in 1897.

Following graduation from West Virginia University in 1883, Hough returned to take his M.A. in 1884 and his Ph.D. in 1894. After teaching for a year in a boys' school at Alton, Illinois, he was appointed to a position under Dr. Otis T. Mason in the division of ethnology at the National Museum, became assistant curator in 1894 and curator upon the death of Dr. Mason, in November, 1908. Hough was not only representative of the Smithsonian Institution but a member of the U. S. Commission to the Columbian Historical Exposition at Madrid in 1892–3, at which time he was designated a Knight of the Order of Isabella of Spain. In the selection and installation of exhibits, he participated actively in nine other national or international expositions between 1907 and 1926. Between 1901 and 1933 he conducted ten Museum expeditions, chiefly to the southwestern United States, in pursuit of ethnological or archeological information.

Although he wrote of aboriginal peoples, historic and prehistoric, in both hemispheres, Dr. Hough is perhaps best known among anthropologists for his studies of fire as an agent in human culture. Beginning with "An Eskimo Strike-a-light from Cape Bathurst," published in the *Proceedings* of the U. S. National Museum for 1888, his bibliography of over one hundred titles (omitting numerous reviews, notes, biographies, the annual reports of his department, etc.) includes no fewer than eighteen papers on fire-making, illumination, heating and lighting apparatus, etc. But the wide range of his interests is only partially illustrated by his published works. He was an authority on old English, French, Italian and American china, on old lace, on violins and early pianos.

His scientific affiliations included membership in the American Association for the Advancement of Science (M89, F90; vice-president of Section H, 1904); the American Anthropological Association (president, 1924); Anthropological Society of Washington (president, 1908–9); Washington Academy of Sciences; Archeological Society of Washington; The American Museums Association; Société d'Anthropologie de Paris; Society of Anthropology and Geography of Sweden; Phi Beta Kappa (W. Va., 1914); the Cosmos Club, Washington, D. C.

By nature generous and helpful, Dr. Hough gave freely—perhaps too freely—of his time to his subordinates and to casual museum visitors on queer missions. With astounding patience he would listen to the very end of long dissertations about inconsequentials; rarely did he have the heart to destroy pet theories built upon the sands of insufficient knowledge. The personification of gentleness, he frequently and knowingly permitted himself to be imposed upon. His personal charm, his unfailing courtesy, his responsiveness and understanding endeared him to all who had the privilege of meeting him, either at his office or in his home. He loved young people, and they, in turn, put faith in him. He was never so occupied that he could not interrupt to admire the fragments of Indian arrowheads and potsherds proudly brought in by school boys for his inspection, and he always took time to point out the significance of these finds and to draw comparisons between them and the products of other, more distant cultural areas. These very human qualities won for Dr. Hough throughout his half century with the National Museum a host of friends to whom he was always an inspiration.

He married Myrtle Zuck, of Holbrook, Arizona, on December 29, 1897. Mrs. Hough, two sons and a daughter, and seven grandchildren survive him.

NEIL M. JUDD

HENRY ETTER STARR

ON November 2, following a brief illness, Henry Etter Starr, head of the department of psychology and director of the Psychological and Mental Hygiene Clinic of Rutgers University, died unexpectedly at

New Brunswick, N. J. He was forty-two years of age. Henry Starr, born in Middletown, Pa., on September 13, 1893, received the B.S. degree in 1917 at Gettysburg College, and a Ph.D. in psychology from the University of Pennsylvania in 1922. His thesis concerned the hydrogen ion concentration of the saliva and emotional reactions. From 1917 to 1924 he taught at the Medical School of the University of Pennsylvania, first as instructor in chemistry and toxicology and then as instructor in physiological chemistry. In 1924 he shifted to the psychology department, being promoted to an assistant professorship in 1927. Dr. Starr was called to Rutgers University in 1928 to be professor of psychology and to head the new department. The Psychological and Mental Hygiene Clinic was established by him in 1929 to serve the university, the community and the state. Dr. Starr served as its director from that time until his death. As a clinical psychologist Dr. Starr was outstanding; he contributed a great deal of his time and energy to the work of the Association of Consulting Psychologists, of which he was the president at the time of his death. He was also a member of the American Psychological Association, a fellow of the American Association for the Advancement of Science, the American Association of University Professors, the Society of Sigma Xi, Phi Beta Kappa and other professional and fraternal societies.

S. S.

WILLIAM CLARDY AUSTIN

WILLIAM CLARDY AUSTIN, professor of physiological chemistry and head of the department of physiological chemistry at Loyola University Medical School, Chicago, Illinois, passed away at his residence in Glen Ellyn on November 20. W. C. Austin was born in Coronaca, S. C., on January 5, 1895. He received his undergraduate training at the South Carolina Presbyterian College. During 1916–21 he instructed in chemistry in the Medical College of South Carolina and during some of the summers of this period he studied for the higher degree in biochemistry at the University of Chicago. In 1922, that institution invited him to carry out studies on yeast lipins as the Fleischmann fellow. He received his Ph.D. in physiological chemistry at Chicago in 1923 and immediately thereafter took charge of the department of physiological chemistry at Loyola University. In 1927–28, Dr. Austin was granted leave of absence as a National Research Council fellow with Dr. C. S. Hudson in the Bureau of Standards. During that year he prepared a new ketose heptose, d-glucoheptulose, through the action $Ca(OH)_2$ on d-α-glucoheptose. He continued his interest in carbohydrate chemistry to the last. His joint publication with Dr. Fred L. Humoller on the preparation of l-allose and l-altrose is recognized as a very important contribution to carbohydrate chemistry because it was the first time that the last two of the predicted sixteen aldose hexoses had been obtained in pure form and their structural relations to l-arabinose and l-ribose established. Dr. Austin was an active member of the American Chemical Society, the American Society of Biological Chemists, the Society for Experimental Biology and Medicine and of the Chaos Club.

F. C. KOCH

UNIVERSITY OF CHICAGO

RECENT DEATHS

DR. JAMES HENRY BREASTED, director of the Oriental Institute of the University of Chicago, died on December 2 at the age of seventy years.

EDWIN WILBUR RICE, honorary chairman of the board of the General Electric Company and formerly president of the company, died on November 25, at the age of seventy-three years.

DR. EDWARD STARR JUDD, chief of the surgical staff of the Mayo Clinic, president of the American Medical Association in 1931, died on November 30 at the age of fifty-seven years.

DR. GEORGE E. BROWN, head of the section of vascular diseases at the Mayo Clinic, Rochester, Minn., and associate professor of medicine, died on November 28, at the age of fifty years.

DR. KENYON L. BUTTERFIELD, president of the Rhode Island State College from 1903 to 1906, the Massachusetts State College from 1906 to 1924 and of Michigan State College from 1924 to 1928, since 1929 counselor on rural work for the International Missionary Council, died on November 25, at the age of sixty-seven years.

DR. ALBERT BLEDSOE DINWIDDIE, since 1918 president of Tulane University, died on November 21, at the age of sixty-four years. Dr. Dinwiddie went to Tulane University in 1906 as assistant professor of applied mathematics and astronomy, becoming associate professor in 1908 and full professor in 1910. Before becoming president he was dean of the College of Arts and Sciences and director of the summer school.

DR. W. P. NORTHRUP, professor of pediatrics at the Bellevue Hospital Medical College, New York University, from 1896 to 1919, when he became professor emeritus, died on November 11, at the age of eighty-five years.

DR. JOHN LEONARD ECKEL, professor of neurology and psychiatry at the University of Buffalo, has died at the age of fifty-five years.

DR. BOLLING HALL CRENSHAW, professor of mathematics at Alabama Polytechnic Institute at Auburn, died on November 25 at the age of sixty-eight years.

DR. MAX HENIUS, president of the Wahl-Henius Chemical Laboratory and Brewing Institute of Chicago, died on November 15, at the age of seventy-six years. Dr. Henius is known for his work on fermentation problems and for improvements in the processes of brewing and bread-making.

SCIENTIFIC EVENTS

THE FISHERY ADVISORY COMMITTEE

SEVENTEEN members of the Fishery Advisory Committee, under the chairmanship of E. B. McGovern, met in the Department of Commerce Building, Washington, for its second meeting on October 21 and 22.

The Secretary of Commerce, Daniel C. Roper, the Assistant Secretary, Ernest G. Draper, the Secretary's Assistant, Chester H. McCall, and the Commissioner of Fisheries, Frank T. Bell, addressed the various sessions of the meeting on problems facing the fishing industry. The seven subcommittees of the general committee presented detailed reports and recommendations for improving the fishing industry in the various spheres of interest under their individual consideration.

During the four general sessions of the committee the subjects of protection of game and migratory fish were dwelt upon at length. The pending Puget Sound-Fraser River salmon treaty was discussed at length, and the importance and necessity of carrying on biological and scientific work by the Bureau of Fisheries as a foundation for conservation and development of the fisheries was stressed. The committee also considered nutrition, food standards and quality of products in the fishing industry, the problems of marketing and distribution and the importance of legislative measures now pending before Congress.

The committee strongly recommended the passage of the Robinson-Patman bill and the Bland bill and House Joint Resolution 248, in the belief that the Federal Government should render aid to the fishing industry in a measure comparable to the aid given to the agricultural industry.

Various members of the Bureau of Fisheries cooperated with the committee by presenting factual data and entering the discussions on policies, including Charles E. Jackson, deputy commissioner, R. H. Fiedler, chief of the Division of Fishery Industries, and Elmer Higgins, chief of the Division of Scientific Inquiry. Mr. Keating, of the State Department, and Mr. Renner, of the National Resources Committee, were also invited to address the committee on the subject of international fishery treaties.

The next meeting of the committee will be held in January, 1936.

NOTES FROM THE MUSEUM OF COMPARATIVE ZOOLOGY AT HARVARD COLLEGE

DR. THOMAS BARBOUR, director of the University Museum at Harvard College, has recently returned from a second journey through South Africa, visiting wildlife reserves and national parks. The results of the journey have just been embodied in a report entitled, "Notes on South African Wild Life Conservation Parks and Reserves," published as Special Publication of the American Committee for International Wild Life Protection, No. 7.

Dr. Marston Bates has been given leave of absence by the governing board of the Museum of Comparative Zoology to join the entomological staff of the Rockefeller Foundation and to work upon the Anopheles of Albania.

Dr. Frank M. Carpenter is on his way east to resume his work at the Museum of Comparative Zoology after having successfully explored several fossil beds of the Middle West, securing several thousand fossil insects, including the remains of an apparently new form which had a spread of wings of about two and a half feet.

The curator of the department of mollusks, William J. Clench, accompanied by John H. Huntington and Henry D. Russell, has returned from an extended journey to Cat Island, in the Bahamas, which is perhaps the least known island in the Archipelago, certainly the largest of the islands never thoroughly explored zoologically.

Dr. T. E. White and L. I. Price, research assistants in the Museum of Comparative Zoology, have returned from a prolonged investigation of certain Permian deposits in Texas and secured among other finds the almost complete dorsal armor of a large Phytosaur.

Henry Stetson continued his study of the geology of the drowned valleys along the continental shelf of the east coast of the United States. Fossils have been recovered from the lower slopes of these valleys which throws much light on their geological history. His report in this connection is well advanced for publication.

The very extensive Botanical Garden, maintained by Harvard University, at Soledad, Cuba, suffered heavy damage to its plantings during the recent hurri-

cane. Fortunately the building housing the laboratory, herbarium and lodgings was not destroyed.

Dr. Thomas Barbour, director of the Museum of Comparative Zoology, has recently been elected a member of the Massachusetts Historical Society and of the American Antiquarian Society at Worcester.

THE ORGANIC CHEMISTRY SYMPOSIUM OF THE AMERICAN CHEMICAL SOCIETY

THE sixth National Organic Chemistry Symposium of the American Chemical Society will meet at Rochester, N. Y., on December 30 and 31 and on January 1. The program of papers and speakers is as follows:

Monday Morning

9:30—Address of Welcome, Samuel W. Clausen, *chairman*, The Rochester Section.

9:45—Response—"Ten Years of Organic Symposia," Roger Adams, president, American Chemical Society.

10:00—"Recent Advances in Our Knowledge of the Carotenoids," Marston T. Bogert.

11:00—"The Synthesis of Phenanthrene Derivatives Related to Natural Products," Louis F. Fieser.

Monday Afternoon

2:00—"The Hormones Challenging the Organic Chemist," Vincent du Vigneaud.

3:00—"Some Recent Advances in the Alkaloid Field," Lyndon F. Small.

4:00—"Acyclic Sugar Structures," M. L. Wolfrom.

Monday Evening

8:00—"Problems in Anemia," George H. Whipple, dean of the Rochester Medical School.

Tuesday Morning

9:00—"Syntheses and Chemical Properties of Orthoesters," Arthur J. Hill.

10:00—"Polysulfones from Sulfur Dioxide and Olefins," Carl S. Marvel.

11:00—"The Chemistry of the Ethylene Bond," Morris S. Kharasch.

Tuesday Afternoon

2:00—"Many-Membered Rings," Wallace H. Carothers.

3:00—"The Reactions of Hydrogen with Organic Nitrogen Compounds," Homer Adkins.

4:00—"Organic Derivatives of Boron," John R. Johnson.

Tuesday Evening

8:00—"The Heats of Hydrogenation of Unsaturated Compounds," James B. Conant and G. B. Kistiakowsky.

Wednesday Morning

9:00—"Relative Reactivities of Organo-Metallic Compounds," Henry Gilman.

10:00—"The Chemistry and Tautomerism of Some Indene Derivatives," C. Frederick Koelsch.

11:00—"New Evidence for the Low Temperature History of Petroleum," Benjamin T. Brooks.

The Rochester Section of the American Chemical Society is acting as host for the symposium. Members of the general committee are Erle M. Billings, V. J. Chambers and W. W. Hartman. Headquarters will be at the Hotel Seneca.

REPORT OF THE SCIENCE ADVISORY BOARD

CREATION of a permanent science advisory board and the development of a national program to make the most effective use of the great scientific services of the nation, were recommended by the Science Advisory Board in a report submitted to President Roosevelt on December 2 by its chairman, Dr. Karl T. Compton.

The proposed permanent agency would be composed of a small group of leading scientific men and engineers who would serve without compensation under the sponsorship of the National Academy of Sciences. The present advisory board, created by President Roosevelt in 1933, has ended its work with the expiration of an extended appointment on December 1.

In outlining the place of science in government, the report says: "There is no need for the government to embark upon comprehensive programs in pure science, invention or industrial development. There are, however, numerous scientific services of such wide scope and universal utility that no agency except the government is competent to handle them adequately. There are other scientific services which are essentially supplementary to non-scientific governmental activities. There are also fields of scientific or technical development which hold evident promise of benefitting the public, but which are not proper or practical fields for private initiative. In these three categories and in this order of importance lie the proper scientific activities of the government."

In the first category are public health, weather forecasting, topographic mapping, development of scientific and technical standards, mineral surveys and statistics, safety codes, patents, soil science, improvement of crops and live stock, national scientific museums and engineering work relating to flood control, water works and aids to navigation. In the second category are scientific aids to national defense and development of standards for the purchase of supplies for government bureaus. The third includes such activities as those of the National Advisory Committee for Aeronautics.

The report directed attention to duplication of effort in existing scientific bureaus of the government

and asserted that freedom of scientific work from political and policy-making influence is of prime importance. It adds that for technical advice the Congress and the executive departments should have ready access to, and should use, the best talents available within and without the government services.

One of the principal recommendations in the report concerns grants-in-aid of research projects which hold definite promise of importance industrially, medically or otherwise in the public interest. The report states that at present there are many developments of this nature which a relatively small amount of financial support would release for the stimulation of industry and commerce, and the improvement of public health. An appropriation of $3,500,000 for scientific research by non-governmental institutions during the next two years is recommended and an annual appropriation of $100,000 for the support of the Science Advisory Board is also requested.

During the past year the board has studied a number of matters connected with the federal scientific bureaus. These reports, which are soon to be made public, cover the mapping services of the Federal Government; the relation of the patent system to the stimulation of new industries; the relationship of the Bureau of Chemistry and Soils to the other bureaus in the Department of Agriculture; medical and public health problems in the Federal Government; the report of the joint committee appointed by the Science Advisory Board and Regional Coordinating Committees of Railway Executives to study the matter of research methods and possibilities in the railway field, and a study of means for lessening the hazard of collision of ships in fog.

SCIENTIFIC NOTES AND NEWS

DR. EDWARD W. BERRY, professor of paleontology and dean of the College of Arts and Sciences at the Johns Hopkins University, has been appointed to the revived office of provost of the university. Dr. Joseph S. Ames, the predecessor of President Isaiah Bowman, was provost from 1926 to 1929, but on his accession to the presidency no successor was appointed.

DR. MAX MASON, who joined the Rockefeller Foundation as director for natural sciences in 1928, becoming president in 1930, previously from 1925 to 1928 president of the University of Chicago, has announced his retirement. He plans to resume his mathematical work.

DR. FRANK SCHLESINGER, director of the Yale University Observatory and professor of astronomy at Yale University, has been made a member of the Legion of Honor by the French Government, with the rank of officer.

DR. MARY B. KIRKBRIDE, associate director of the Division of Laboratories and Research of the New York State Department of Health, has been presented a gold medal by the New York State Association of Public Health Laboratories "in recognition of her devoted service to that organization." Dr. Kirkbride was elected in 1919 as the first secretary-treasurer of the association and has acted in that capacity since that time.

THE medal of the American Society of Civil Engineers, awarded for an original paper on sanitary engineering, has been given to John H. Gregory, professor of civil and sanitary engineering at the Johns Hopkins University, for a paper on "Intercepting Sewers and Storm Stand-by Tanks at Columbus, Ohio." The medal has been awarded only three times since it was instituted in 1924.

THE Hubbard Gold Medal, award of the National Geographic Society for geographic achievements, will be presented on December 11 to Captain Albert W. Stevens and Captain Orvil A. Anderson, commander and pilot of the stratosphere balloon, *Explorer II*. General Pershing, a trustee of the society, will make the presentations in Constitution Hall.

AN award of 10,000 Belgian francs as first prize in the competition sponsored by the George Montefiore Foundation of the University of Liége, Belgium, for "the greatest contribution to the art and science of electrical engineering during the last three years," has been made to Gabriel Kron, of the General Electric Company, for his memoir on "Non-Riemannian Dynamics of Rotating Electrical Machinery." The first prize in the competition, which is international in scope, has not been awarded to an American since 1923 when it was given to Dr. J. B. Whitehead, dean of the engineering faculty, the Johns Hopkins University.

PROFESSOR MARIE-VICTORIN, head of the department of botany of the University of Montreal, has been awarded the Coincy Prize by the Paris Academy of Sciences.

DR. HANS DRIESCH, professor of philosophy at the University of Leipzig, has been elected an honorary member of the British Philosophical Society.

DR. CHARLES E. COTTON, secretary and executive officer of the Minnesota Livestock Sanitary Board, in recognition of his work in the eradication of bovine tuberculosis was the guest of honor in November at

the annual dinner of the Minnesota Public Health Association in Minneapolis. Speakers included Dr. Morris Fishbein, editor of the *Journal* of the American Medical Association; Dr. Charles H. Mayo, of Rochester, Minn., president of the State Public Health Association; Dr. J. Arthur Myers, professor of medicine and preventive medicine and public health, the University of Minnesota School of Medicine, and Frederick E. Murphy, publisher of the Minneapolis *Tribune*.

AT the annual meeting of the board of trustees of the Carnegie Foundation for the Advancement of Teaching, held on November 27, the following officers of the board were elected for the year 1935–36: *Chairman,* Thomas W. Lamont, of New York City; *Vice-chairman,* Frederick C. Ferry, president of Hamilton College; *Secretary,* L. D. Coffman, president of the University of Minnesota. Dr. W. C. Murray, president of the University of Saskatchewan, presided as chairman of the board. New trustees elected were Chancellor Samuel Paul Capen, of the University of Buffalo, and President Harold W. Dodds, of Princeton University. Members of the executive committee re-elected were Frederick C. Ferry and William Allan Neilson. Dr. Walter A. Jessup is president of the foundation.

OWING to his advanced age Professor von Eiselberg has resigned his presidency of the International Congress of Surgery to be held at Cairo in December and has been succeeded by Dr. J. Schoemaker, of The Hague.

DR. WALTER H. MEYER, chief of the section of forest measurements at the Pacific Northwest Forest Experiment Station at Portland, Ore., has become professor of forestry at the University of Washington. Dr. Meyer will take up his work in January.

DR. H. ARTHUR MEYER, of the Swiss Forest School at Zurich, who has completed a year's study of forest biometrics in the Forest Service at Washington, has accepted a professorship in the new School of Forestry being organized by the Mexican Forest Service at Mexico City.

PROMOTIONS in the science departments of the Michigan College of Mining and Technology include: Dr. Ella Lucille Wood, from associate professor to professor of geography, and J. M. Harrington and Fay Partlo, from assistant to associate professor of mathematics and physics, respectively.

AFTER a period of service of ten years, Dr. Donald F. Jones has retired from the editorship of *Genetics,* and Professor L. C. Dunn, of Columbia University, has been elected to succeed him. Manuscripts intended for publication in *Genetics,* and all editorial correspondence, should now be addressed to the editor of *Genetics,* 804 Schermerhorn Extension, Columbia University, New York City.

DR. MENAS S. GREGORY, whose enforced resignation as head of the Bellevue Psychiatric Clinic in June, 1934, resulted in a libel suit brought by him against Dr. S. S. Goldwater, hospital commissioner, has been appointed by Dr. Goldberger consultant psychiatrist of the Psychiatric Division of Bellevue Hospital. The post is a new one, established by the Department of Hospitals and the Medical Board of Bellevue. Dr. Gregory preferred not to reassume the active duties of the directorship.

KENNETH ABLEITER, instructor in soils at the North Dakota Agricultural College, has been named senior soil technologist in the Division of Soil Survey, Bureau of Chemistry and Soils, Washington. He will have charge of a new project for determining the best uses for land. The salary has been fixed at $4,600 per year.

DR. J. J. DURRETT, of New York, has been reappointed chief of the Drug Division of the Food and Drug Administration. He will take charge of the work early in January. He returns to his former post after an absence of a little more than four years. During that period he was associated with E. R. Squibb and Sons, of New York City.

DR. ABRAHAM WHITE, instructor in physiological chemistry at the Yale University School of Medicine, has been awarded a grant by the Committee on Scientific Research of the American Medical Association for the study of the chemistry and metabolism of the sulfur of proteins.

PROFESSOR RICHARD GOLDSCHMIDT, of the Kaiser-Wilhelm Institut für Biologie, Berlin-Dahlem, Germany, arrived in the United States on November 26 to deliver a series of lectures. He will lecture before the Society of Sigma Xi at the University of Chicago on December 3 on "Genes and Hormones in Sex Determination." He will also lecture at Yale University, Columbia University, Cornell University and the University of Rochester. He may be reached during December in care of the Zoological Laboratory, University of Chicago, or the Department of Zoology, Columbia University.

PROFESSOR REGINALD A. DALY, of Harvard University, delivered the annual fall lecture in geology at Syracuse University on November 19, speaking on "The Changing World of the Ice Age." He also addressed the advanced students of the department of geology and geography on "Submarine Trenches."

DR. ARTHUR H. COMPTON, of the University of Chicago, delivered the first of a series of Dohme lectures

at the Johns Hopkins University on December 3. His subject was "Recent Studies in Cosmic Rays."

DR. CLINTON J. DAVISSON, of the Bell Telephone Laboratories in New York, spoke before the Physics Colloquium at Brown University on November 18 on "Electron Optics."

WALTER HOGE MACINTIRE, of the department of chemistry at the Agricultural Experiment Station, University of Tennessee, gave the fifth Harvey W. Wiley memorial address of the Association of Official Agricultural Chemists at the annual meeting on November 11 in Washington. Dr. Wiley was a founder and the first president of the association.

PROFESSOR HEINRICH RIES, of Cornell University, gave a series of three lectures on clays and clay products before the department of geology of Columbia University on November 11, 12 and 13.

F. J. SIEVERS, of the Massachusetts State College, in his capacity as director of the Herman Frasch Foundation for Research in Agricultural Chemistry recently addressed the members of the honor society Gamma Sigma Delta at the University of Missouri on "Changes Necessary in Research to Meet Changed Conditions in Economics."

THE second lecture in the Smith-Reed-Russell series for this year at the School of Medicine of the George Washington University, was held on November 26. The speaker was Dr. Siegfried J. Thannhauser, of Freiburg, Germany, and the Boston Dispensary. The subject of his address was "Cholesterol, its Chemical, Physiological and Clinical Aspects."

DR. W. C. CURTIS, president of the Union of American Biological Societies, writes that a meeting of the council will be called at 3:00 P. M., Sunday, December 29, in the Jefferson Hotel, St. Louis. This meeting will consider: (1) The current problem of *Biological Abstracts;* (2) the future of the Union; (3) reports of officers and other business. It is earnestly requested that each member-society arrange for its members of the council to be in attendance, or arrange for attendance of one or more substitutes for such council members who can report to the society at its next business meeting. Any biologist who is vitally interested in the future of the *Abstracts* and who may be in St. Louis on December 29 is invited to attend the meeting and participate in the discussion, although not a member of the council or an appointed substitute.

AT the meeting of the American Academy of Tropical Medicine in St. Louis on November 20 and 21 the following officers were elected: Dr. Richard P. Strong, of the Harvard Medical School, *president;* Dr. Wilbur A. Sawyer, director of the International Health Board of the Rockefeller Foundation, *vice-president;* Dr. Ernest Carroll Faust, of the Tulane University School of Medicine, *secretary;* Dr. W. W. Cort, of the School of Hygiene and Public Health, the Johns Hopkins University, was reelected *treasurer.* Dr. William H. Taliaferro, of the University of Chicago, and Dr. Thomas T. Mackie, of the School of Medicine of Cornell University, were elected members of the council. Initiated by the academy, the American Foundation for Tropical Medicine held its organization meeting, electing as president Dr. Isaiah Bowman, president of the Johns Hopkins University, and as executive secretary Dr. Earl B. McKinley, dean of the School of Medicine of the George Washington University. The foundation will be incorporated in the District of Columbia and will hold its next meeting late in January when a formal program will be adopted for 1936.

IT is announced that the *Journal of Industrial Hygiene,* edited at the Harvard School of Public Health, Boston, will take in 1936 the name *Journal of Industrial Hygiene and Toxicology.* It will resume its former publishing schedule of ten issues a year instead of six and the content of original papers will be increased about 50 per cent.

DISCUSSION

CONFIRMATION OF COSMIC PHENOMENON

TWO types of confirmation have appeared for the phenomenon I described on page 351 of the October 11 issue of SCIENCE. The first was the occurrence on October 24 of a general fadeout of very high radio frequencies. On October 10 began a great increase in sun-spot activity, accompanied by a general improvement in radio transmission on the higher frequencies. Amateurs and others found that they received excellent daytime signals on much higher frequencies than usual. By October 21 to 23 the upper limit of frequency had reached the highest value ever observed by the National Bureau of Standards. Then, for a single day, October 24, this was completely reversed. The upper limit of frequency on this one day dropped to half its value on the preceding days, and on October 25 and succeeding days returned to the high previous values. This was accompanied also by a remarkable change in the virtual height of the F_2 layer of the ionosphere; this height shot up to 460 km on October 24 from a height of about 250 km on the preceding and following days. These changes were the most

pronounced ever observed by the bureau. October 24 was a day of considerable magnetic disturbance.

Magnetic disturbances, sun-spot activity and poor high-frequency radio transmission have hitherto been considered to go together in general, but with many puzzling exceptions. The present results may help to unscramble the relation, and the following hypothesis is offered. High-frequency radio transmission improves as general sun-spot activity increases (probably because of increased ultraviolet radiation), but some particular, relatively sudden eruptions on the sun have the reverse effect (impairing high-frequency radio transmission on the illuminated side of the globe) and also give rise to terrestrial magnetic disturbances. It appears that the relation between the sudden solar and radio disturbances is a simple one. The wide-spread daytime radio effect is approximately synchronous with the solar eruption, depending directly on the changed ionization produced in the ionosphere by the solar emanation. The magnetic disturbance, however, is a derived effect resulting from the currents flowing in the ionosphere as the charges therein redistribute themselves. Magnetic disturbances therefore appear an uncertain length of time after the causative solar disturbance, and it would be difficult to identify cause and effect. Such identification is possible, however, for the radio disturbances.

This is borne out by the second type of confirmation of the phenomenon, *viz.*, reports of optical observation of changes on the sun which occurred at the same times as the radio fadeout reported. In response to a request from Dr. Lyman J. Briggs, director of the National Bureau of Standards, to Dr. George E. Hale, Mt. Wilson Observatory, and through the courtesy of Dr. S. B. Nicholson, in charge of the Mt. Wilson solar observations, I have received a report made by R. S. Richardson of that institution. This report indicates that the spectrohelioscope showed sudden marked changes in form and intensity of a hydrogen flocculus within a few minutes of the time of each of the radio fadeouts of July 6 and August 30, and also showed a similar phenomenon on October 24. (No observations were made at the times of the March and May fadeouts.) Mr. Richardson's report says the August 30 and October 24 eruptions were unusual. Data are not available as to whether wide-spread radio fadeouts occurred at the times of other notable solar flocculi eruptions.

The synchronous radio fadeouts and visible solar eruptions, lasting only a few minutes, appear to be some sort of climax of a process occurring over a period of hours. The October 24 radio observations revealed the disturbed condition over such a longer period rather than the climactic sudden type of fadeout. It should be noted, by the way, that the direct correlation of solar and radio effects with which we are here concerned are daytime phenomena, *i.e.*, on the side of the globe illuminated by the sun. Night-time radio phenomena are far more variable and may be expected to correlate more particularly with terrestrial magnetic phenomena.

It is by no means proved, but it may be that solar flocculi eruptions (visible or not) are the usual cause of wide-spread daytime impairment of high-frequency radio transmission and also of at least some terrestrial magnetic disturbances. Even if only a small proportion of the effective eruptions should have a visible stage, certainly further study of such visible effects and comparison with ionosphere data obtained by radio means will be of value in the further elucidation of the causes of magnetic disturbances. The National Bureau of Standards and the Carnegie Institution are carrying on a limited program of continuous determination of ionosphere data by radio means, and are setting up equipment to do this in more thorough fashion. This gives new emphasis to Dr. Hale's proposals for continuous spectrohelioscopic observations.

J. H. DELLINGER

CHIEF, RADIO SECTION
NATIONAL BUREAU OF STANDARDS

MIGRATION OF GRAY SQUIRRELS

AT the present time considerable amount of speculation is passing through the minds of the zoological world in an endeavor to solve the migration of gray squirrels. It is reported that a horde of these animals are migrating from New England to New York covering an area of 100 miles wide. Recently a number of dead squirrels were picked up on the shore of Gilboa aqueduct. Between Albany and the Rip Van Winkle Bridge 2,000 remains were found along the west shore of the Hudson River.

This migration is not the result of campers invading their habitat or being attacked by parasites, as some writers have postulated. The slaughter of hawks, owls and foxes under the guise of conservation has made it possible for the red squirrels to multiply to the extent of breaking up the balance of nature, thus creating living conditions which would lead to extermination if migration did not take place.

It is not generally known that a large percentage of gray squirrels are emasculated annually by the pugnacious reds. In years past the writer has shot and trapped alive a large number of gray squirrels and close observation showed 98 per cent. mutilation. The technique used by the red squirrel is simple but most efficacious. Contact is made by leaping from a limb of a tree, a distance of fifteen feet or more, making a perfect landing on the back of the unsuspecting gray engaged in digging seeds. With a quick body twist

the unfortunate victim is pinned on its side and in less than ten seconds emasculation is effected.

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FOREIGN JOURNALS IN THE USSR

IN the article on "The Fifteenth International Congress of Physiology: The Congress and Russian Physiology," printed in the issue of SCIENCE for September 13, I stated that our Russian colleagues in physiology are being, to some degree, intellectually starved, owing to their inability to buy foreign journals; and I appealed to their Government to help them by providing the "exchange" necessary to buy more. Here are some facts concerning the total number of copies of three British journals sent to the USSR and, for comparison, to the U. S. A.:

	USSR	U. S. A.
Journal of Physiology	27	241
Journal of Experimental Biology	7	130
Biochemical Journal	47	374

That the "exchange" is available is shown by the fact that the Government of the Soviet Union is spending a large sum of money in buying Professor Kapitza's apparatus from Cambridge University: a sum large enough to pay for 100 subscriptions to each of these journals for 15 years.

These figures show the situation rather clearly. In the USSR, it is frequently and loudly announced that the Government is far more concerned in helping science than is that of any other country; the net result, however, is that in the United States government and private effort together buy nine times as many English journals in physiology and its two allied sciences as does the Government of the USSR. If this fact can be brought to the attention of the authorities in the Soviet Union it may stimulate them to do better, and so considerable advantage may result to our colleagues there.

A. V. HILL

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MISTAKEN IDENTITY?

MY attention was recently called to a brief, center-page article in *Liberty* for November 16, 1935, on "Not one in a thousand knows, sometimes air is heavier than water," by E. G. Conklin. There is a cartoon of a mythical professor at a laboratory table, and I am wondering if the announced author of the article is also mythical. As I have never written or spoken a word on the subject discussed, I am taking this means of disclaiming any responsibility for the article. I do not know of, nor can I find in any of the biographical dictionaries any other E. G. Conklin than myself, and I have asked the editors of *Liberty* to inform me who the reputed author of this article is, but the editorial secretary writes in reply: "I am sorry that I can not give you the address of our Mr. E. G. Conklin, who is the author of 'Not One in a Thousand Knows.' But if you wish to send a letter to him in our care, I'll be glad to see that it is forwarded to him promptly. Strange enough, the author of this feature is also connected with one of our large universities."

E. G. CONKLIN

PRINCETON, N. J.

SPECIAL ARTICLES

A HIGHLY ACTIVE PRESSOR SUBSTANCE FROM CEREBRAL VENTRICULAR FLUID OF HUMAN BEINGS

PAGE[1] has reported that human blood, cerebrospinal and ascitic fluid yield extracts with alcohol which are vasopressor. They differed from other extracts by the fact that activity is dependent on the functional intactness of the central nervous system. Destruction of the central nervous system below the mid-brain abolishes their effectiveness in elevating arterial pressure in anesthetized cats.

Clinical observation of patients suffering from essential and malignant hypertension suggests that in some of them signs and symptoms occur simulating those following irritation of centers in the diencephalon. This "diencephalic syndrome" has been recently described by Page.[2] Search was therefore made to ascertain whether the fluid which bathed this portion of the brain contained substances which might stimulate it.

Ventricular fluid was secured at autopsy and alcoholic extracts prepared. After removal of the alcohol and precipitate they were injected intravenously into cats anesthetized with ethyl urethane.

Arterial pressure fell slightly and rose sharply to a high peak. Similar extracts prepared from plasma cause arterial pressure to rise more slowly, but the elevated pressure is maintained for much longer periods (10 to 30 minutes) (Fig. 1). Destruction of the central nervous system abolishes completely this action, in this manner resembling extracts of plasma. Removal of the adrenal glands one-half hour before injection does not abolish the extract's action, hence

[1] I. H. Page, *Jour. Exp. Med.*, 61: 67, 1935.

[2] I. H. Page, *Am. Jour. Med. Sci.*, 190: 9, 1935.

it appears unlikely that its effect on blood pressure is mediated by adrenalin.

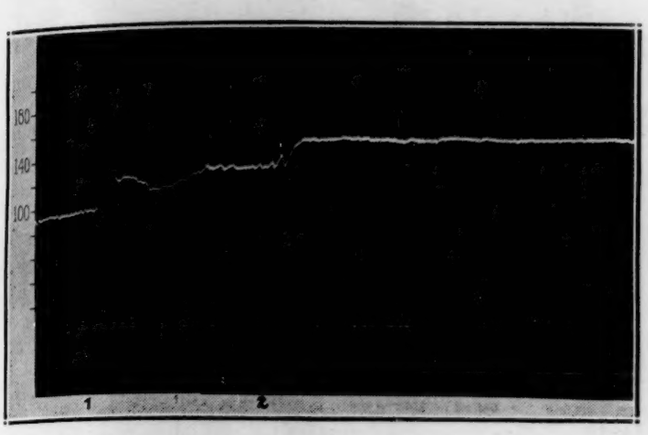

FIG. 1. Effect on cats' blood pressure of injection of extract of cerebral ventricular fluid from a patient suffering from malignant hypertension. No. 1. Extract equivalent to 4 cc of ventricular fluid. No. 2. Extract equivalent to 10 cc of blood plasma of same patient. Time marker = 10 seconds.

Pressor substance from ventricular fluid resembles that from plasma in many respects, but its concentration or potency is far greater. Quantitative aspects of it in relation to hypertension will soon be reported.

Ventricular fluids from five cases of malignant hypertension, one case of hypertension associated with adrenal carcinoma and three cases of nephritis with hypertension have been examined. All were found to contain pressor substance. Fluid obtained at operation from the lateral ventricles of a patient suffering from epilepsy with hydrocephalus, and one with a cerebral tumor, yielded extracts which were inactive. Ventricular fluid from a patient with normal blood pressure who died as the result of a gun-shot wound contained but moderate amounts. Spinal fluid but rarely contains it in high concentration.

Assay of the potency of extracts is difficult on account of dependence on the functional intactness of the central nervous system for the response. Sufficient numbers of ventricular fluids from patients suffering from different diseases have not as yet been examined to furnish grounds for claim that this pressor substance is always associated with hypertension.

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EFFECTS OF ETHYLENE ON PLANT GROWTH HORMONE

HETEROAUXIN, or plant growth hormone (β-indolylacetic acid) is known to have several effects on plants, including promotion of stem elongation, inhibition of bud growth, stimulation of root formation, production of stem swellings and stimulation of epinastic movements of the leaves. With the exception of the first two, ethylene gas also has these effects.

According to A. E. Hitchcock, ethylene, heteroauxin and other substances all act in essentially the same way.[1] This conclusion is based, apparently, on the similarity of the effects of ethylene to those of heteroauxin. There are many cases, however, where these two substances do not have the same effect.

For instance, heteroauxin increases the growth rate of *Avena coleoptiles,* and the amount of increase is dependent on the amount of heteroauxin supplied.[2] If ethylene has the same effect, it should increase the growth rate, and the degree of increase should depend on the concentration of the ethylene. However, four groups of Avena seedlings were placed for twenty-four hours in, respectively, air, 0.001 per cent. ethylene, 0.2 per cent. ethylene and 2 per cent. ethylene. The rate of growth in all three of the groups treated with ethylene was approximately the same, and was about 30 per cent. less than the rate of growth of the controls. It thus appears that, in this case, ethylene could not have acted in the same manner as a growth hormone.

It is well known also that heteroauxin increases the number of roots formed by pea cuttings.[3] These cuttings can take up enough hormone to give maximum root formation when placed inversely in a solution of hormone for twelve hours. However, when they were placed for twenty-four hours in an atmosphere containing ethylene (whether treated with hormone or not), root formation was not affected.

Cuttings of *Salix* were also used for tests on the effect of ethylene. The experiments described here were performed in May. The cuttings were of second-year wood and about eighteen centimeters long. Four groups of cuttings were treated in different ways, as follows: (1) controls, (2) 0.1 per cent. ethylene for two weeks, (3) heteroauxin applied to the top of the cutting in the form of lanoline paste,[4] (4) treated both with heteroauxin and 0.1 per cent. ethylene. The roots were counted two weeks after the experiment was

Method of treatment	Average number of roots per cutting	Increase over controls caused by treatment
Controls	11.9 ± 0.6	
Ethylene	16.2 ± 1.2	4.3
Heteroauxin	23.1 ± 1.5	11.2
Ethylene and heteroauxin	40.5 ± 2.3	28.6

[1] Contributions from Boyce Thompson Institute, 7: 1, 87, 1935.

[2] F. W. Went, *Botanical Review,* I: 162, May, 1935.

[3] Proceedings, Koninklijke Akademie van Wetenschappen te Amsterdam, XXXVII: 7, 445, 1934.

[4] The lanoline paste contained one part of heteroauxin to two thousand of lanoline.

begun. Following are some data obtained from these experiments. The average number of roots per cutting is given, with the probable error.

It seems impossible to explain these results on the theory that ethylene acts in the same manner as a growth hormone. It will be seen that the ethylene alone increases the number of roots by 4.3, and the heteroauxin alone increases it by 11.2. If the ethylene acts in the manner of a growth hormone, the ethylene and heteroauxin together could not increase the number of roots by more than 15.5, or the sum of the two preceding figures. Nevertheless, in this experiment the increase was not 15.5 or less, but 28.6. It appears, therefore, that ethylene can not be acting directly to stimulate root formation, but that it must in some way cause the growth hormone to become more active.

In none of the above experiments can the ethylene have acted in the same manner as a growth hormone. It seems probable, therefore, that all the effects of ethylene on growth are to be explained, not as direct effects of ethylene alone, but as effects of ethylene on a growth hormone.[5]

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THE ANTISCORBUTIC VALUE OF DANDELION[1]

RECENTLY two studies[2,4] appeared in SCIENCE concerning the chemical composition of dandelion and its value as a food. Bennett[2] has shown that dandelion contains large amounts of protein, fat and little fiber. It contains much more calcium and phosphorus than either lettuce, cabbage leaves, mangold leaves or spinach. According to Sherman,[3] however, there is much less calcium in dandelion than in the above-mentioned vegetables, and Youngburg[4] finds the phosphorus to be much lower. We were especially interested in the vitamin C content of dandelion and have determined it by three different methods: (1) Titration by the oxidation-reduction indicator, 2,6-dichlorobenzenone indophenol; (2) the authors' enzymic method[5]; (3) animal assay, using guinea-pigs as experimental animals. Analysis by both chemical methods has shown that the ascorbic acid content of dandelion varies between 0.08 and 0.10 mg per g of fresh greens. The animal experiments have shown that 10 gms of the plant are necessary for proper growth and the prevention of loss of weight and the development of scurvy, when using the basal diet of La Mer, Campbell and Sherman.[6] Our experiments show that the ascorbic acid content of dandelion is about 0.1 mg per gm, which is only 1/6 to 1/10 of that of spinach and is much less than that of cabbage. The minimum protective dose of ascorbic acid for guinea pigs, when macroscopic evidence is considered, is 0.9 mg per animal per day, according to Birch and associates.[7] This figure is probably more nearly correct than the one of 0.5 mg given by Göthlin.[8]

For comparison we are showing the vitamin C content[9] of the greens of parsnips, parsley and turnips (Table I). Some of these are quite rich in this ingredient.

TABLE I

	Ascorbic acid mg per g
Dandelion, greens	0.08–0.10
Spinach, fresh	0.92–1.0
Cabbage, new[10]	0.40
Parsley, greens	1.4 –1.8
Parsnips, "	2.10–2.16
Turnips, "	1.1 –1.2
Beets, "	0.36–4.0

Thus, although dandelion contains more protein, fat, carbohydrates, iron and ash than some other leafy foods, it is not a good source of vitamin C.

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[5] This is also in agreement with the work of van der Laan. "Also sind bei Avena die Beschädigungen, die durch Aethylengas verursacht werden, auf eine Hemmung der Wuchsstoffbildung zurückzuführen." Recueil des travaux botanique néerlandais, XXXI: 733, 1934.

[1] This investigation was aided by a grant from the Committee on Scientific Research, American Medical Association.

[2] Bennett, SCIENCE, 80: 142, 1934.

[3] Sherman, "Food Products," third edition, The Macmillan Company, New York, 1933.

[4] Youngburg, SCIENCE, 80: 338, 1934.

[5] Tauber and Kleiner, *Jour. Biol. Chem.*, 110: 559, 1935.

[6] La Mer, Campbell and Sherman, *Jour. Am. Chem. Soc.*, 44: 165, 1922.

[7] Birch, Harris and Ray, *Biochem. Jour.*, 27, 590, 1933.

[8] Göthlin, *Nature*, 134: 569, 1934.

[9] Tauber and Kleiner, *Jour. Biol. Chem.*, 108: 563, 1935.

[10] Bessey and King, *Jour. Biol. Chem.*, 103: 687, 1933.

BOOKS RECEIVED

CHALK, L. and others. *Fifteen South African High Forest Timber Trees. Vol. III of Forest Trees and Timbers of the British Empire.* Pp. 103. Illustrated. Oxford University Press. $2.50.

HERRICK, GLENN W. *Insect Enemies of Shade-Trees.* Pp. viii + 417. 321 figures. Comstock, Ithaca, N. Y. $5.00.

JONES, H. SPENCER. *Worlds without End.* Pp. xv + 329. 32 plates. Macmillan. $3.00.

SCHMIDT, HARRY. *Einführung in die Vektor- und Tensorrechnung unter besonderer Berücksichtigung ihrer physikalischen Bedeutung.* Pp. v + 125. 20 figures. Max Jänecke, Leipzig. 5.80 RM.

SUTHERLAND, G. B. B. M. *Infra-Red and Raman Spectra.* Pp. xi + 112. 27 figures. Methuen, London. 3/-.

WALSH, J. L. *Interpolation and Approximation by Rational Functions in the Complex Domain. Vol. XX of Colloquium Publications.* Pp. ix + 382. American Mathematical Society.